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Electrical World

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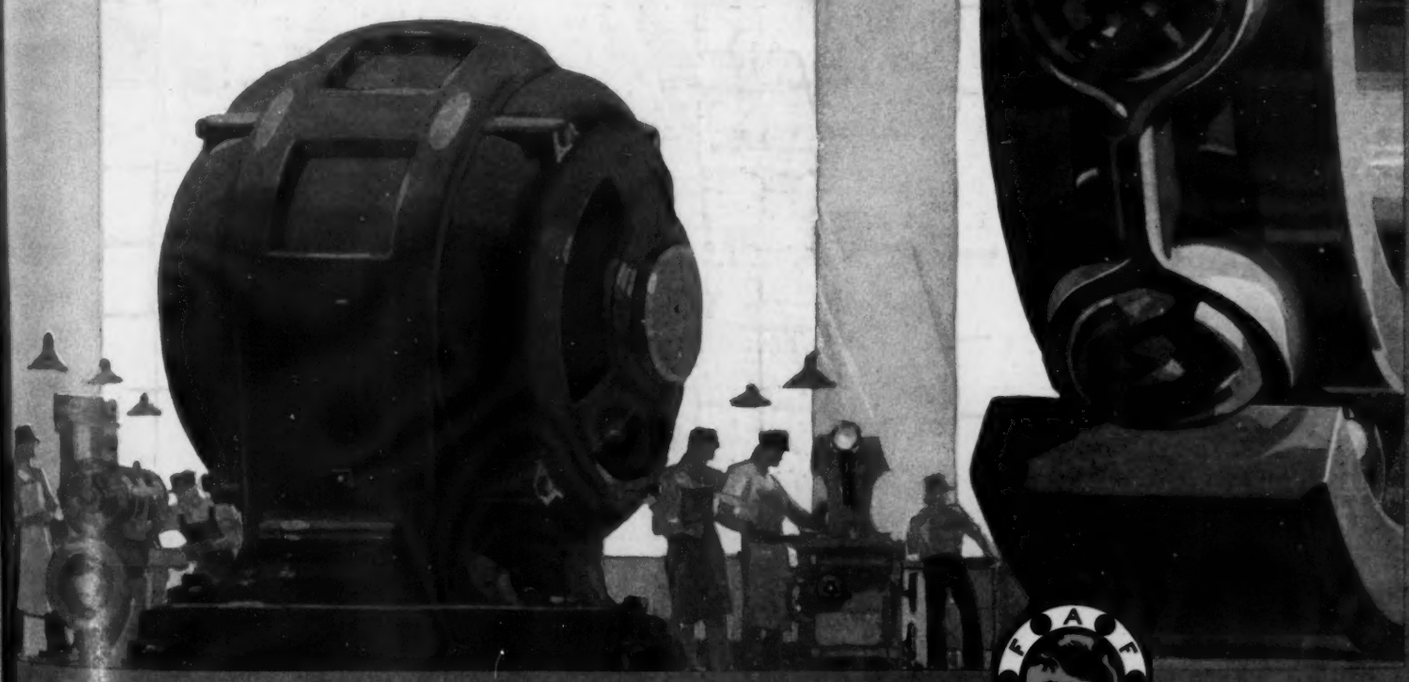

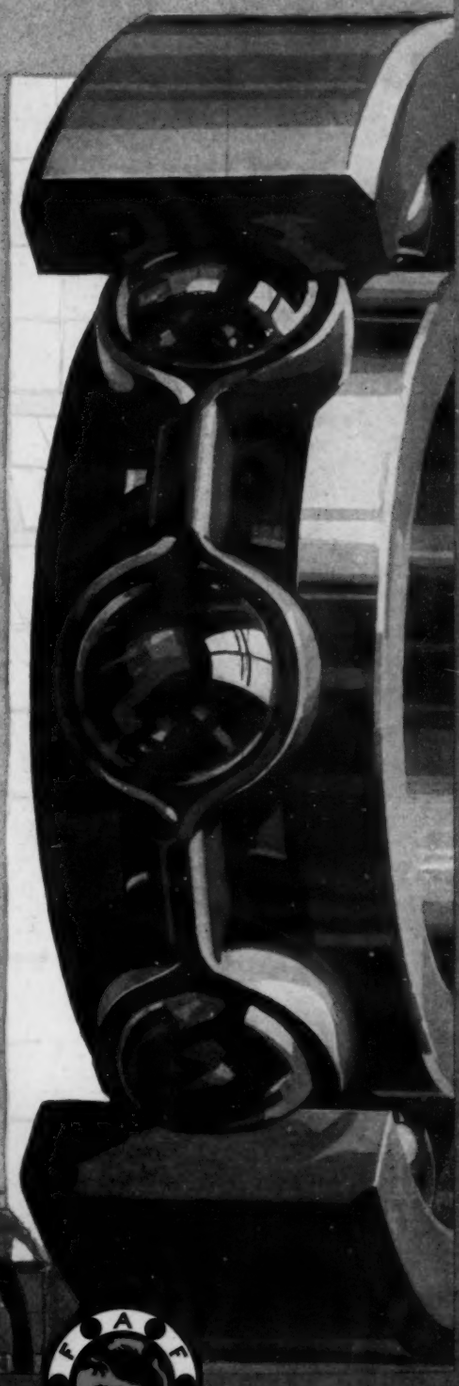

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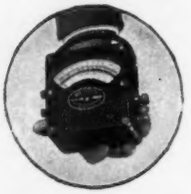

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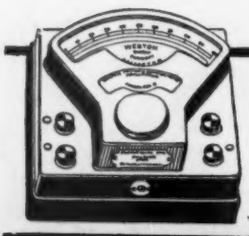

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Electrical World

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Disposing of Surplus Energy on the Pacific Coast

WITH the large number of new hydro-electric developments being brought into operation on the Pacific Coast, the utilities must find some outlet for the surplus energy. Some of them have already buckled down to the job and started campaigns for greater loads, chiefly cooking and heating. Without much beating of drums, the Washington utilities have succeeded in connecting many thousand electric ranges to their circuits within the year and some of them are turning their attention to incidental house-heating loads. The problem is to find a ready and satisfactory market for large amounts of energy in districts where industrial establishments and factories do not abound and where chief reliance must be placed in the domestic load. That an outlet will be found for all of the energy available goes without saying. Meanwhile activities on the Pacific Coast will bear watching by the entire industry because it is a condition and not a theory which confronts the electric public utilities there. It is usually supposed that saturation is being approached in the far West; but this opinion is not predicated on fact, and before another year rolls by Pacific Coast companies will have established new records in household use of electricity which will remove any thought of saturation from the minds of central station executives. We have only begun to use electricity in this country, great as the record is, and newer uses are constantly coming forward, as those who watch the Pacific Coast will soon learn.

Distribution in the Limelight

THREE or four years ago many light and power properties found it necessary to remodel their distribution systems. To determine proper engineering lines to follow many analytical studies were made in the light of the facts and experiences then available, and in a majority of instances the three-phase four-wire secondary system was chosen as best.

Today a condition exists where many properties have changed over their distribution system as a whole or in part in conformity with the theoretical studies previously made. A general checking of actual results is now going on and there seems to be quite a little disagreement in the conclusions. Some two-phase four-wire and two-phase five-wire system advocates believe their system provides the answer, and some three-phase four-wire system advocates believe the solution to the problem is found in their system. There is disagreement as to general conclusions and as to details of individual systems and the whole subject is under close scrutiny.

Any distribution system will work, as a survey of actual installations will show, but it is to the economic and service interests of the industry to have the greatest possible degree of standardization in distribution. The future requirements of service must be measured in reaching a decision, and the influence of changes in primary distribution voltages and practices must be weighed. It is evident that no agreed-upon answer is now available and it is to be hoped the discussion at Saratoga Springs and elsewhere will be carried further and a conclusion reached. Too much is at stake to build the future distribution systems on guesswork or opinions when actual data are available.

Ill-Founded Attack on New York Power Mergers

THE officials of the city of New York have filed briefs with the Public Service Commission of New York against certain up-state power mergers. In this the Mayor of New York is within his rights, and if half the abuses which he claims have resulted from such mergers did actually occur he is doubly obligated to object. However, most of the points raised by the corporation counsel are easily brushed aside. The production and distribution of electricity is a monopoly, acknowledged by the laws of the state, and therefore subject to regulation. Capital stock issues bear no relation to the price which the consumer pays for his electricity. In 1919 the Public Service Commission of New York went on record in the following admirable statement:

"Although this commission has stated many times the true ruling which must be adopted in determining what is meant by 'return on invested capital' as applied to a rate case, we will risk the repetition of it for the reason that the argument made in almost every case which comes before the commission shows that the ruling is not generally understood. By 'invested capital' for the purpose of computing rate of return the Public Service Commission means the actual value of the property used in giving the service. This has no connection whatever with the share capital in the corporation, nor is it material whether the capital was raised by the issuance of bonds or sale of stock. Neither does it make the slightest difference whether the issued capital stock is 'watered,' nor to what extent the 'water' may be present. The injection of 'water' cannot add one cent to the value of the property which is actually used, and that is the only inquiry which the commission is interested in."

As for stock manipulations in the public utility field, there have doubtless been some in New York, and it is the duty of the Attorney-General of the state to proceed against the manipulation under the recently enacted "blue sky" law. So far as we know, no electric public utility company is seeking to evade responsibility through loopholes in the law. They are just as zealous as the officials of the metropolis of the Western Hemisphere in seeking to perfect the law and to hasten the time when the question of jurisdiction in interstate business will be definitely settled by agreement between the states; the utilities choosing to live under state

regulation rather than federal. Mergers, even though they result in profit to bankers and owners of stock, are designed for the purpose of effecting economies and thus keeping down or reducing the cost of electricity to the consumer, and in the majority of cases the public has been the chief gainer, the Hylan administration notwithstanding.

Electrical Industry Harmonious

INTERNAL troubles in any industry are always expensive and affect service and progress disastrously. Disputes and disagreements in the mining, building trades and railroad organizations continue to handicap the prosperity and well being of all concerned in these industries. It is a cause for congratulation that the light and power industry has maintained internal harmony from the days of its inception.

The 350,000 persons in the light and power industry are united in a co-operative and friendly effort to bring still greater progress for their industry. All strive to achieve every possible economy and to enhance the quality and diversity of the service rendered. All realize that industry prosperity results in individual prosperity.

In a friendly and human association employers and employees in the light and power industry have worked for the common good. Through conscious effort a real partnership in the industry has been brought about whereby all are enthusiastic in their tasks and have a common conception and ideal. Educational work, adequate salaries and wages, employee stock ownership, promotions based on merit and a real leavening of human kindliness have brought about the situation and have produced the team that has astounded the world by its development.

No industry can maintain good external relations that lacks good internal relations, and the happy internal situation in the light and power industry augurs well for continued prosperity.

Governor Pinchot's Tour in Behalf of "Giant Power"

AT THE present time Governor Pinchot of Pennsylvania is touring the West on "giant power." Why the Governor should stump the country on a subject with which he is not expert, heaven knows; except it be to create political effect. Reports indicate disappointing receptions and antagonistic newspaper comment. Meanwhile Pennsylvania's greatest industry, coal mining, faces industrial strife and many power plants will be severely handicapped in rendering service if labor trouble at the coal mines ensues. Such a situation would cause any other Governor many disquieting nights, but the aspiring Pinchot sleeps on.

Did Gifford Pinchot choose to speak on forestry, the whole world would listen. Schooled abroad, and in American universities, the Governor of Pennsylvania is well versed in the art of forestry and his fellow countrymen are beholden to him for his services during the Roosevelt administration. But on the subject of electricity, its economic generation and transmission, Governor Pinchot does not speak with authority. Moreover, he strays from the paths of truth when he says, as he did in Portland, Spokane, and elsewhere on the Pacific Coast recently, that interconnection is "bringing about enormous economies which the companies are keeping almost entirely for themselves . . . the customer getting little or nothing." This statement is best answered by facts from his own state.

The United States census of central electric light and power stations shows that in Pennsylvania in 1922 half the cost of production is made up of coal, and since the 1917 census the cost of coal has increased 86.3 per cent. Total production costs have increased 101 per cent, and yet the ultimate consumer of electricity in Pennsylvania actually paid 15 per cent less for his electricity in 1922 than he did in 1917, the years in which the census was taken. Therefore in making his statements the Governor of Pennsylvania does a gross injustice to the electric public utilities of his own state and misleads thousands of his hearers on the accomplishments of the electrical industry throughout the country. A political house built upon such sand is bound to fall. Governor Pinchot in his tirades against the electric light and power industry "rams his quill with scandal and with scoff, but 'tis so very foul it won't go off."

Transients and Surges

THERE is no more important question in the extension and development of the field of electrical engineering that that of the insulation of transmission lines. For around this problem center all questions of the extension of transmission distances, reliability of service, and so ultimately those of expansion of service and the undertaking of new projects. As a consequence no technical problem appeals with greater interest to designing and research engineers than that of line insulation. It is one of the most active and fruitful fields for investigation. This investigation extends from the study of the materials of insulation and the design of new insulators, on the one hand, to a study of the causes leading to insulator troubles on the other. It is in this latter field that the greatest uncertainty lies, for the causes of abnormal voltage disturbances such as lightning, arcing grounds, load changes, etc., are so rapid in their action as to make it practically impossible to secure a permanent record, not only of the actual disturbances on the lines themselves, but even of disturbances artificially created and controlled in the laboratory.

This problem has been studied for years. Various types of recording apparatus have been designed, beginning with the single spark gap and running through several forms of so-called "surge recorder." The difficulties in all these attempts have been, first, in the selection of a device which would respond to the extremely short internal voltage disturbances, and, second, to record the response so that not only the form of the disturbance but also the exact instant of its occurrence might be known. Those who have been following the attacks which have been made on this problem will be greatly interested in the improvements announced at the recent A. I. E. E. convention in the klydonograph of J. F. Peters. This instrument, it will be recalled, depends upon the peculiar property of a photographic plate of recording with great regularity an electric discharge from an electrode placed in contact with it. It appears that the circular pattern caused by this discharge repeats itself with remarkable fidelity under repeated discharges of the same type. The diameter of the pattern establishes the value of the voltage, the general photographic character, the polarity and also the steepness of the impulse. The instrument as now improved includes a continuously moving photographic

film with time record, and in the hands of an experienced observer appears to offer a very valuable new instrument for the study of transmission line disturbance of all kinds. Voltage on the instrument is limited to 18 kv., but it is adapted to all line voltages through several simple forms of high voltage potentiometer and induction devices.

The paper referred to reports the results of a number of studies on existing lines which are of very great interest. For example, it is shown that the greater number of disturbances on the usual type of line are limited to surges of magnitudes 1.4 to two times normal voltage, and the maximum value of transient voltage so far recorded is 4.2 times normal, these higher values having been shown to be due to the presence of arcing grounds. Another conclusion is that oscillations of unusually high voltage and high frequency have not been found in the investigations so far made. At first sight the instrument appears to have many disadvantages in questions of accuracy, reliability, dependence on a photographic film, and in the need of an experienced observer in its use. On the other hand, it must be remembered that up to this time we have had practically no method for the reliable recording of these short interval disturbances, and that the instrument, even with its limitations, really does give us an insight into these disturbances which we have never had before. It therefore offers a notable advance in our knowledge of transmission line disturbances.

Pre-equipment with Data as an Aid to Quick Decisions

TRANSMISSION and distribution engineers have frequently been criticised because they have allowed their systems to grow up "like Topsy" without much, if any, engineering back of them as a whole. The defense is raised that when a transmission or distribution line is requested of the engineering department it is usually declared that it should have been installed yesterday or the day before. As a consequence no time is left for engineering. This contention can hardly be disputed if an engineering study is to be started and completed after an order is issued for a line.

However, there are studies which can be made before lines are requested the results of which would enable exercise of better economic judgment after an order is received. First of all, a general policy can be established as to whether it would be best to develop toward a radial, a loop or a combination system, as to where the substations must be planned for, where the backbone lines must be and for just what sectionalizing provision should more specifically be made. Data can be collected and plotted graphically regarding economic relations between different types of construction based on some unit that will serve as a guide when a rapid decision must be made. For example, since the cost of lines depends chiefly on the cost of supports and this cost depends more on type and spacing than on carrying capacity, it might be possible to develop data which would show the relative cost of using different span lengths per thousand feet, mile or some other unit for different voltages. Then when the conductors necessary for transmitting any load are calculated for electrical requirements they can be modified for mechanical requirements.

Specific examples of opportunities for advance study can be thought of by the engineer himself if he will just recall some of the calculations which he has to make on every job. Although he cannot work them out for the specific cases in advance, not knowing all conditions, he can prepare in readily usable form data which will facilitate last-minute studies. A few examples of data with which the distribution department of the Detroit Edison Company equips itself are given in an article elsewhere in this issue. These include (1) annual charges of 4,600-volt, three-phase power lines of different size at different loads, (2) annual cost of energy, losses for different divisions of load, (3) annual charges on secondary installations for different load densities employing different sizes of wire and transformers, and (4) annual cost of transformer installations at different loads.

Better Electric Lighting Tends to Improve Load Factor

LIGHTING load has often, if not generally, been associated with poor load factor. Therefore when more lighting is mentioned it is natural to think of a decrease in load factor. This, however, is not usually the case. Better lighting usually means a reduction in glare by shading the light sources or by locating them properly and also an increase in intensity of illumination. Research and practical experience are teaching that the intensities of illumination commonly found are far from adequate for the best vision. As a consequence progressive users of artificial light are increasing these intensities considerably, and from their installations much that due thought would have made obvious is being learned.

For example, where the intensity of artificial illumination has been increased it is found that artificial light is used more hours per day than previously. The explanation seems to be simple, for artificial lighting is effective longer in the morning and earlier in the afternoon when it is of high intensity than when it is feeble. Obviously artificial light will not generally be called into use until it can make itself felt. "Daylighting" in many factories, offices and stores does not average more than a few foot-candles, and at the ends of the day the intensity is much less. Of course, it begins from zero at a certain hour in the morning and ends at zero at a certain hour in the afternoon or evening, the hour depending upon the time of the year, the location and other factors. As the intensity of artificial illumination is increased the period during which it is perceptibly effective is correspondingly increased. In many cases an intensity of ten foot-candles would be quite effective throughout the entire day.

This increase in load factor is not confined to industrial and commercial lighting; it is possible in the home as well. Here there is a tendency to operate the new kitchen units for considerably longer periods than the old ones, because on the average the intensity of illumination is several times greater than it was previously and therefore is effective longer in the morning and earlier in the afternoon. Furthermore, it is used on cloudy days, when the old, inadequate units would be of little value. If modern lighting is installed in the laundry in the basement, it can usually successfully make itself felt in the presence of the inadequate daylight throughout the day. There are still other ways in which better lighting improves the load factor, but this one is of particular interest because greater intensities of artificial light are universally needed.

Permanent Spectacular Illumination for Niagara Falls

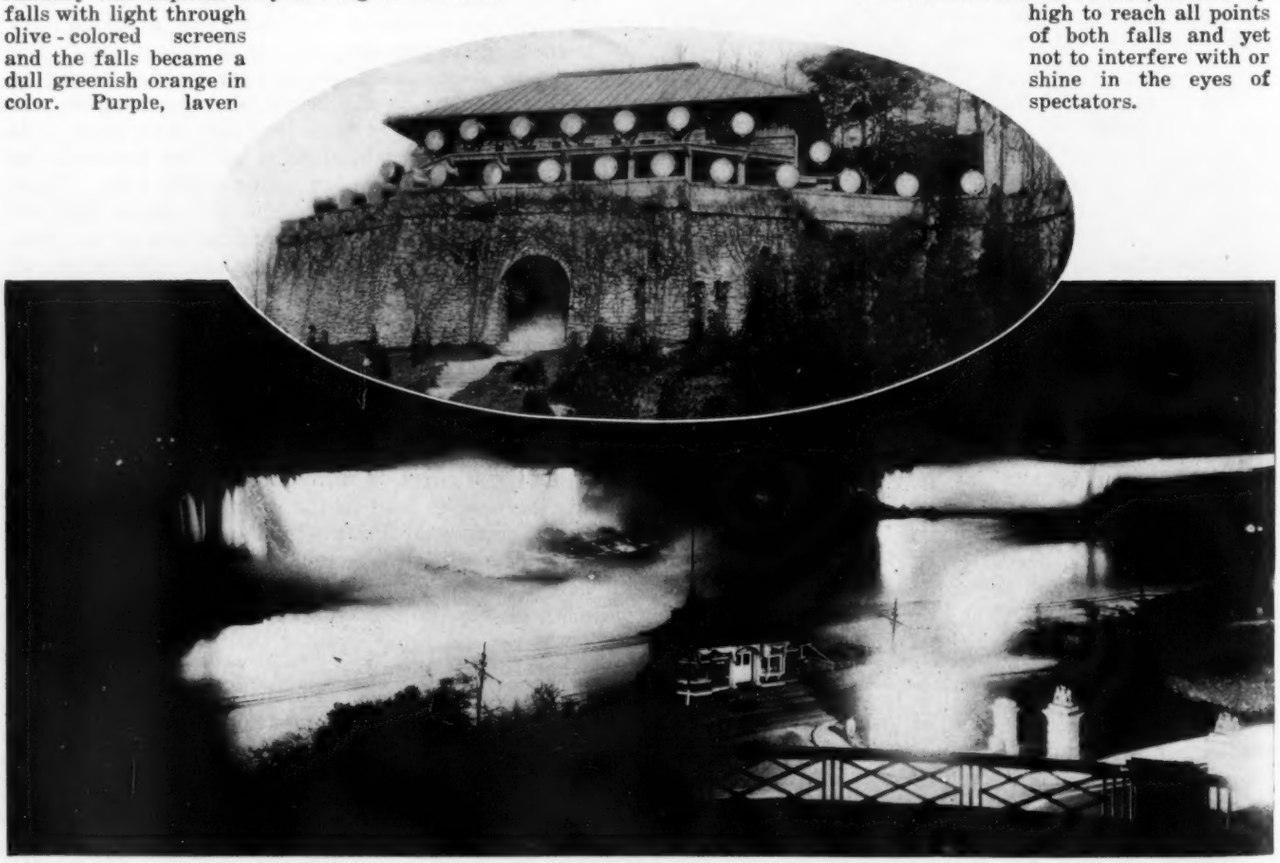
ONE and a third billions of candle-power of varied color lights from twenty-four powerful searchlights were turned on Niagara Falls on May 25 in the presence of more than 65,000 persons from both the United States and Canada, gathered to witness the formal opening of the new, spectacular illumination of the falls. Mounted on a parapet on the Canadian side of the Niagara River, the lights scintillated over the falls in ever-changing hues.

The effect of the total eclipse of last January was duplicated by bathing the falls with light through olive-colored screens and the falls became a dull greenish orange in color. Purple, lavender, green, yellow, pink, crimson and white were each used in turn. Pencils of white light danced from one fall to the other, to the city of Niagara Falls in the distance and into the clouds.

The spectacular lighting is to be permanent. Ordinarily the falls are to be floodlighted with white light, but on special occasions there will be light drills with color effects, with a man operating each of the units. In 1907 the falls were spectacularly illuminated to a lesser extent over a period of a month.

Co-operation of the two cities of Niagara Falls (New York and Ontario), the Queen Victoria Park Commission, the Ontario Power Company and the General Electric Company made the permanent lighting a reality. A new type of 36-in. searchlight was used. This unit has easily adjusted electrodes, a motor-driven ventilator and higher efficiency than the type generally used for this purpose.

The battery of searchlights is mounted on a balcony of a surge tank in Victoria Park in Canada, sufficiently high to reach all points of both falls and yet not to interfere with or shine in the eyes of spectators.



Economics of the Distribution System

Relative Importance of Distribution to Central-Station Investment and Operating Expense—Losses in Distribution—Some Fundamentals of Analyzing Costs and Planning for Economy, Efficiency and Future Growth

By HOWARD P. SEELYE
Distribution Engineering Department, Detroit Edison Company

THERE can be little doubt that the ideal of every company generating and distributing electrical energy is to generate and distribute that energy from coal pile to consumer's meter at the least possible cost, with due regard to good service. This principle is so axiomatic as to need no discussion. It follows that every link in the chain connecting the consumer to the coal pile should be given careful attention to the end of developing its greatest economy both individually and also in relation to the other links. One very important link is the distribution system, fully as important as substation, transmission or generation systems. It is the link, however, that is most apt to be neglected in the application of engineering principles of design.

It would be inconceivable for a large generating station to be built or a high-tension transmission line to be constructed without consideration of the fact that economy of operating costs and carrying charges play an important part in the design. But how much real thought is given on many systems to the economy of size and arrangement of primary feeders, distribution transformers, secondary mains, etc.? Yet all of the energy generated by that plant and transmitted by that transmission line must pass through this distribution system before it appears as salable energy at the customer's meter. The energy losses here will be fully as high as and perhaps much higher than in transmission lines and substations and the investment represented is probably in most cases considerably greater. Often, however, the only thought given to it is to lay out a system that will operate and give the customer the service required, with perhaps in some cases a little consideration of Kelvin's law in determining the wire sizes. More often it is left to the line foreman on the job to put in what he sees fit.

Probably the reasons why the distribution system is sometimes overlooked lie in the facts that the distribution system is more widely scattered and hence less evident than other parts of the system and that the practical results obtained from engineering work on the distribution system are hard to show concretely. A large generating station is an imposing evidence of great investment to which one may point with pride. We can go and look at it and see the fires burning and hear the turbines roar. Power is handled in bulk and may be accurately measured, hence any economies effected are readily discernible and may be clearly translated into dollars. Similar, in less degree, are the transmission lines and substations. But for the distribution system we are more likely to visualize a more or less unsightly line of wood poles and maze of wires which occupies our back alleys; which is a necessary evil but which we would like to forget lest we feel apologetic. Yet that distribution system probably represents nearly as large a part of our total property as the generating station. Also it is very difficult to show tangible results of economies applied to this system. It is so widespread, the loads carried are so diversified and so variable, both in demand and in consumption, from day to day and year to year, and are metered at so many different points that any very definite exhibit of actual results accomplished is often well nigh impossible. They should be evident, it is true, in the final analysis of yearly investment and operating costs for the system, but even here there are so many other contributing factors that it is difficult to state confidently that any particular effects are the results of economies on the distribution system. For it may be found that real economy lies in increasing the investment to lower the losses or, conversely, an increase in losses may effect a greater economy in investment. We must ask rather that the economies we can exhibit be accepted as representative of others fully as large which we can only compute; that the percentage economy we can figure for the small individual job be considered to apply similarly to the large general class of similar jobs. It is the purpose of this article to show something of the importance of the distribution system and the magnitude of some of the results that may be expected from the application of engineering principles to its design.

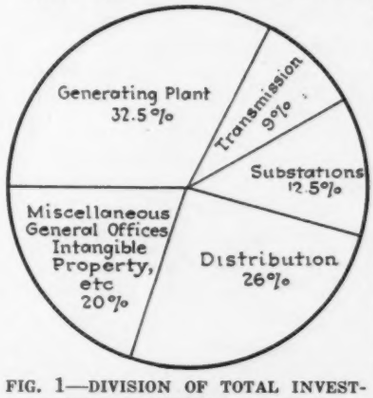


FIG. 1—DIVISION OF TOTAL INVESTMENT IN A CENTRAL-STATION SYSTEM

It might be well, first, to define our use of the term distribution system. In one sense the whole system, outside of the generating station, is the distribution system in that it distributes the energy generated. In a more limited sense, however, we may generally subdivide this into a transmission system, substations and the local distribution system, which distributes to the customers from the points of concentration, the substations. Although the problem of economical distribution includes all parts of the system and they will all be included to some extent in this discussion, it is desired to emphasize especially the local distribution system as that part which is often least considered.

The importance of this distribution system as a part of the power company's property is best exemplified by the proportion of the total property investment which it represents. This will, of course, vary somewhat with the nature of the company and the type of loads served.

The accompanying diagram, Fig. 1, gives an example of one company carrying a general diversified load of power, light, street railway, etc. It is probable that the figures of other companies of a similar character will not be widely different. It will be seen that the investment necessary for the distribution of the energy generated (including transmission and substations) is nearly 50 per cent of the total investment of the company and 50 per cent greater than that in the generating plants. Of this more than half is in the local distribution system—that is, primaries, transformers, secondaries, etc.—and this alone is nearly as great as the investment in generating plants. As a concrete example, if the system had a total property value of $25,000,000, on the basis of the division shown in the diagram the generating plants would represent about $8,100,000, the whole system of distribution about $12,000,000. Of this, transmission would represent $2,300,000, substations $3,200,000 and local distribution $6,500,000.

Losses in Distribution

The proportion of the energy generated that is lost in its distribution depends somewhat, of course, on the type of loads carried as well as on the design of the system. If a large amount of power is wholesaled at primary or transmission voltages, the general percentage for the whole system will be lower on account of the fact that the customer in this case pays for transformer and secondary losses. Considering power that is sold at secondary voltage, however, the loss is probably somewhere between 15 and 30 per cent, according to the system—that is, for a system generating 300,000,000 kw.-hr. during the year, from 45,000,000 to 90,000,000 kw.-hr. will be lost in distributing it to the customers. If the cost averages $0.01 per kw.-hr., including all charges up to point of utilization, which for most systems with steam generation is probably low, this loss would amount to $450,000 to $900,000 per year, a not insignificant figure. Of this, the local distribution system may take one-half or more, the remainder being used in substation and transmission.

I should like to state at this point that these figures are presented not as generally representative of any system or type of system, as the division of investment and per cent of losses would not be alike on any two systems. They are given simply to illustrate the magnitude of the investment and losses pertaining to the distribution system. They were based, however, on actual values for a known case and it is probable that the proportions for other systems would be of a similar magnitude.

In this connection also the figures published recently in the ELECTRICAL WORLD (March 14, 1925) on the value of additions to generating, transmission and distribution systems in the United States for several years are interesting. These show that over a period of five years from 1921 to 1925 the total cost of these additions and extensions is divided as follows:

Generating plants	49.3%		
Transmission (including substations)	21.2%	Transmission and distribution	50.7%
Distribution	29.5%		

The same authority gives figures for the total central-station energy generated and that sold during the months of October, November and December, 1924. The difference amounts to 19.3 per cent of the total generated. Part of this is energy used by the companies themselves, but this would be probably not more than 1 per cent in most cases. Since a part of this is wholesaled energy, it is apparent that the figures given above for losses on secondary retail power are more or less substantiated.

The object in presenting these figures is not simply to show what is well known, that we spend a great deal of money and lose a large part of the energy in distributing it. Rather it is to bring out the fact that the system of distribution as a whole and the local distribution system in particular are relatively large factors in the total cost of producing and selling energy and as such warrant as much attention and engineering skill as are granted the other parts of the property. W. S. Murray in a recent letter to the ELECTRICAL WORLD says that "80 per cent of the cost of power to the consumer lies in getting that power to the customer after it has been generated." We cannot distribute energy without losses and we must expect a large investment in the distribution system, but it behooves us to see that that money is wisely spent and that those losses are not greater than is consistent with economy. In fact, the widespread nature of the distribution system and the difficulty of accurately checking results would indicate the greater necessity for correct engineering and the continuous application of economic study to its installations and its subsequent operation.

The objection is sometimes raised that the uncertainty of the amount and types of load with which we have to deal—that is, the possibility of sudden changes at any point, due to unforeseeable conditions in the locality itself, the state of the art, or business in general—makes any refined calculations a waste of time. This is true to a certain extent. We must usually deal with averages rather than specific cases. While in certain cases we may err, in general, since the average deals with a large number of such cases, the net result of a careful study is far more likely to be economy than if guesswork or rule-of-thumb methods are depended upon. We cannot make an economic study of every individual secondary main that is run, but rather we should develop certain standards that will cover a large number of similar secondary mains. On the other hand, the detailed layout of individual lines in the field may offer opportunities for real economies if carried out with the idea of providing for present and future demands in the most economical way consistent with the type of service required and considering all affecting elements.

It will be the purpose in what follows to show in a general way what sort of things may be accomplished by such engineering work and the magnitude of the results that are possible.

Calculating Annual Costs of Distribution

It is recognized that purely economic considerations are not the only factor and sometimes not even the most important factor in deciding between two or more possibilities in any design. Questions of public relationship, sightliness of structures, special service requirements, local governmental regulations, condition of money market and general financing policy all have their bearing, and the successful engineer must take them into consideration. Underlying them all, however, is the principle enumerated in the first paragraph

of this article—that is, the principle of "least possible cost consistent with good service." Allowing for other considerations dictated by necessity or good judgment, it is the principle upon which final decision should be based.

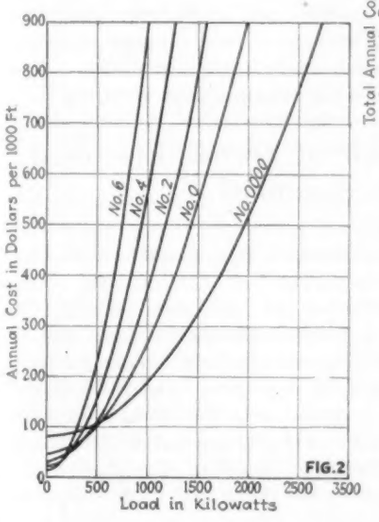
Least cost as here used refers to least annual cost. First cost is not true cost. It is sometimes important as limited by the amount of money available at any time, but it must be recognized that whenever first cost is the deciding factor it is very likely to be at the expense of annual cost and the eventual result is a loss.

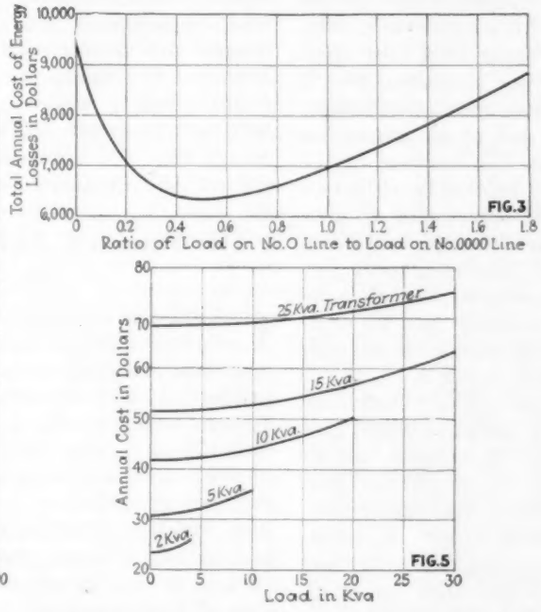
The following examples are taken from studies made under certain actual (and not unusual) conditions of load, voltage, etc., and are based on costs determined as accurately as was possible at the time the studies were made. While they are not to be considered of general application, they are at least indicative of the magnitude of what may be discovered by a study of other similar conditions.

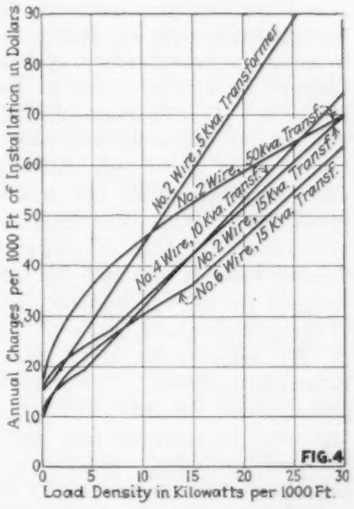
1. *Primary Lines.*—Fig. 2 shows a comparison of the total annual costs per 1,000 ft. of line for various sizes of wire under various loads on a 4,600-volt, three-phase power line. The most economical size for any load is apparent. What it is wished to bring out especially is the actual amount in dollars that may be saved by the use of one size of wire rather than another. Take, for example, a load of 1,000 kw. It might be carried satisfactorily on No. 2 wire under certain conditions. No. 0000 wire, however, would give an annual cost about $185 less for 1,000 ft., or $555 per year if the line were 3,000 ft. long. A similar comparison may be made between No. 0 and No. 0000 at 1,500 kw.

Fig. 3 shows the total annual cost of energy losses on two parallel lines, with various divisions of the total load between the two, the total load being 4,000 kw., at a fairly high load factor (about 40 per cent). The natural division of load, if the lines were tied together in parallel, would be about 44 per cent to the No. 0 and 56 per cent to the No. 0000, or a ratio of 0.785. It may be seen that this is not far in cost from the most economical ratio of 0.5 (that is, one-third the load on No. 0, two-thirds on No. 0000), although there is a difference of $250 per year. If one line only is used, however, and the other held merely as a throw-over, it will be seen that the cost is about $3,000 a year more than for the most economical division. If the load is equally divided (ratio = 1) the excess cost is about $500 per year. It must be recognized, of course, that the most desirable division of such a load is not always practicably possible. However, if the economics are understood, the best division possible under the circumstances can be chosen.

2. *Secondaries.* Fig. 4 shows a comparison between the total annual cost per 1,000 ft., including both wire and transformers, for several combinations of wire size and transformer size on single-phase secondary installations under certain conditions, the voltage drop being limited to 3 per cent. For simplicity, only a few of the possible combinations are shown. The others are, for the most part, intermediate in cost to these. It is apparent what the most economical installation for any density of loading is and how much cheaper it is than any other. For example, at 15 kw. per 1,000 ft. the annual cost with No. 6 wire and 15-kva. transformers is about $6 per 1,000 ft. less than with No. 4 wire and 10-kva. transformers, or No. 2 and 15-kva. transformers. It is $22.50 less than with No. 2 wire and 5-kva. transformers. The latter might be an unusual condition, but is not at all impossible, if little consideration is given to the layout of the distribution. These figures are small in themselves, applying to only 15 kw. of load. If the condition is repeated up to a load of 10,000 kw., the possible savings are well worth while—that is, from $4,000 to $15,000 per year. The probable future growth of load must be taken into account in this case, of course, and such size of wire used as will be economical over a long period.






Annual Charges per 1000 Ft. of Installation in Dollars
No. 2 Wire, 5 Kva. Transformer
No. 2 Wire, 10 Kva. Transf.
No. 4 Wire, 10 Kva. Transf.
No. 2 Wire, 15 Kva. Transf.
No. 6 Wire, 15 Kva. Transf.
Load Density in Kilowatts per 1000 Ft.
FIG. 4

FIGS. 2 TO 5—ANALYSIS OF TRANSFORMER AND DISTRIBUTION COSTS AND LOSSES

Fig. 2—Annual cost of a typical primary line with different sizes of wire.

Fig. 3—Energy losses with different divisions of load on parallel lines of different size.

Fig. 4—Annual cost of secondary installations using various sizes of wire and transformers.

Fig. 5—Variation of annual cost of transformers according to amount of loading.

3. *Transformers.*—Fig. 5 shows the total annual charges for various loads on different sized single-phase transformer installations, under ordinary residence lighting load and certain other assumed conditions. It is given here to show the monetary value of keeping transformers loaded well up to capacity. Take the 25 kva., for example. At full rated load of 25 kva. the annual cost is about $73, or $2.92 per kilovolt-ampere. At 15 kva. load the annual cost is about $70, or $4.67 per kilovolt-ampere. That is, at 60 per cent load the transformer cost is $1.75 more per kilovolt-ampere per year than at full load. Similarly with the 15-kva. transformers. At 15 kva. load the cost is $3.63 per kilovolt-ampere per year. At 60 per cent load (9 kva.) the cost is $5.85 per kilovolt-ampere per year, or an increase of $2.22 per kilovolt-ampere. If this condition is generally true on a system, it may be seen that the excessive cost may be considerable—in the neighborhood of $20,000 per year for a 10,000-kva. load, for example. It is a generally recognized fact that, with loads of the residence lighting characteristic, it is safe to load transformers at peak load considerably beyond their rating. Hence it is not at all impossible to keep the transformer loading on the average in the vicinity of 100 per cent at least, especially in urban territory. In this connection it is interesting to note that at 30 per cent overload, for example, a 15-kva. transformer costs only $2.85 per kilovolt-ampere per year or about $0.80 per kilovolt-ampere less than at rated load. Also, the greater economy per kilovolt-ampere at full load of larger sized transformers over smaller ones is evident, the 25-kva. being about $0.70 cheaper per kilovolt-ampere than the 15-kva. The choice of transformer size, however, is a problem in which cost of the secondaries must also be considered, as in Example 2 above. The only way in which the best transformer economy may be reached is by regular testing and by careful and continued study of loads, increase in loads, transformer spacing, etc. In one actual case (on power loads) by a thorough survey of loads, diversity factors, etc., 35 per cent of the transformer capacity was removed from the lines.

The above are only a few of the examples that might be cited of the economies that may be effected by careful engineering on the distribution system. They show, however, that the magnitude of the results possible is worthy of consideration, when it is remembered that the small savings in the individual case is multiplied many times over the whole system. The same principles may be applied with equal advantage to the choice of voltage, to power factor improvement, to underground line problems, etc. They may also be used profitably in transmission line design to determine the most economical size of conductor, voltage, span, route, etc., and are of use in deciding the most advantageous substation sites, etc. The variety of problems is almost infinite and their study may be carried to any degree of refinement desired. As a rule, however, extreme refinement is unwarranted due to the variable nature of the various factors with which we are dealing. Ordinarily it is desirable to deal only with major problems individually and in detail and for the everyday small problems in design deal with them as classes and establish rules and standards which may be quickly referred to in making a particular layout. It must always be recognized, as was pointed out above, that there are other considerations than strictly theoretical economics that enter into nearly every problem and sometimes these predominate. Good engineering requires comprehensive planning to provide for future changes in physical conditions and increases in load, and here alone large economies can be effected if the plans are based on careful study of past and present conditions and are tempered with sound judgment. The knowledge of the economics of the problem under different assumptions is a criterion whereby that judgment may be guided, so that, while in every particular case the most economical condition may not be attained, still, on the average, the desired ideal of a system which will "distribute the energy generated at the least possible cost consistent with good service" is approached.

In a succeeding article there will be taken up the methods of making such economical studies. In "Economics of Electrical Distribution," by P. O. Reyneau and the author of this article, the fundamentals of the subject are set forth in considerable detail. It is felt, however, that there is a need for something somewhat simpler which, while possibly not so strictly accurate, will be of readier application to the average problem where time for a detailed study is not available. The subject will be treated with this purpose in mind.

The Business Side of French Electrical Development

CAPITAL invested in French electrical industries during 1924 exceeded one billion francs, including new enterprises and new capital for existing ones. The production and distribution of electrical energy in France now employs a capital exceeding four and a half billion francs. The number of employees exceeds 25,000. A recent census of resources lists 109 central stations of 10,000 kw. and over, the total reaching 3,000,000 kw. The smaller stations are rated at 500,000 kw. in all. Consumption per head of population increased 20 per cent during the year and is now double that of five years ago.

The electrical manufacturing industry has an invested capital of two billion francs against three hundred million francs in 1913. Before the war the industry employed 25,000 workers; today this figure has increased to 70,000. Annual output is estimated at one and a half billion francs as compared with two hundred million francs before the war, but it must not be forgotten that the franc has only a fourth of its pre-war value. Strict calculation would seem to indicate that the output of electrical manufactures all along the line had doubled in quantity (weight) in the interval referred to.

The following figures of electrical imports and exports are of value in estimating the situation:

	Exports, Francs,	Imports, Francs	Export Gain, Francs
1921	211,000,000	163,000,000	48,000,000
1922	211,000,000	118,000,000	93,000,000
1923	269,000,000	154,000,000	115,000,000
1924	413,000,000	184,000,000	229,000,000

If the growth of exports is gratifying to the French industry, the diminishing imports are accounted for by the growing production facilities of the country and the fact that in the early years of the table post-war conditions inflated importation above normal demand. The franc had also a higher exchange value in 1921 and 1922 than today.

Should Central Stations Merchandise Electric Refrigeration?

How All Interests Should Co-operate—Distribution Must Be Uncontrolled by Utilities—A Pioneering Field for Central Stations to Help All Refrigeration

By WINSTON PAUL
President Domestic Electric Company, Inc., New York

EVERY electric service company today realizes the extremely profitable and attractive character of the electric refrigerator load. This load is greatest in the summer time, which is the period of the least requirement for electric lighting. The demand per unit is low and the operation of the motor is frequent, but not for long periods. This causes a leveling out of the power curve in any district having numerous installations.

The many advantages of the refrigeration load has caused many power companies to wish to increase the use of both commercial and household refrigerators on their lines. To accomplish this result some companies have undertaken the merchandising of electrical refrigerators. Others have consulted with manufacturers of this equipment for co-operative effort.

A few central stations have undertaken the merchandising of electric refrigerators with marked success. Some companies which have undertaken this have had results that were disappointing. The executives of every power company should study carefully the most efficient and effective manner of increasing the use of electric refrigerators in their territory.

In some cases the absence of effort on the part of any manufacturer or distributor makes it necessary for the electric service companies to undertake the sale of one or of all makes of refrigerators. There are other territories where the manufacturers or distributors of electric refrigerators are well organized from a sales and service viewpoint and where it is unwise and uneconomic for the utility company to duplicate the existing organization with a sales and service organization of its own.

Four Interests Affected

There are four interests affected by electrical refrigeration:

First and paramount—The user or consumer, generally called the public.

Second—The manufacturer, who is responsible for the correct design and careful making of the apparatus.

Third—The distributor, who is responsible for the selection of a high-grade sales force and the proper advertising, installing and especially servicing of the product in use.

Fourth—The electric light and power company, which makes a profit on every electric refrigerator each month after it is installed.

Electric refrigeration, both commercial and household, needs the co-operation of all the interests above described. Central stations, manufacturers and distributors should supplement, and not compete, one with the other. The field is big enough to enable the power companies to make a splendid profit from this attractive load. They need not be envious of the profit of the manufacturer or the distributor. They should hasten the extension of electric refrigeration by speeding up the manufacturer and the distributor rather than to weaken them with competition of powerful and well-organized electric companies.

Winning the Approval of the Public

There is a growing tendency on the part of some central stations to endeavor to absorb the third function with their own. Whereas many power companies are satisfied to make a profit on the current sold to so attractive a load there are other companies that wish also to make a merchandising profit. Strenuous efforts are now being made by the heads of many electric service companies to win public approval and public good will for their organizations as a primary necessity for their future growth and progress. These efforts will be seriously retarded by the methods of the merchandising departments of some of these same companies in trying to merchandise in competition with the local electrical industry.

Harm must come to the industry if every time a new electric device becomes popular the manufacturers and distributors find that the power companies attempt to control its distribution. Many keen and far-seeing electric service company executives have given up merchandising for the purpose of maintaining better relationship and building better good will both with the public and with the electrical trade. In those communities where the utility company merchandises and competes with the electrical dealers in the sale of appliances antagonism at times is bound to arise. Competition with local electrical, hardware and similar dealers frequently pays dividends in ill will which greatly overbalances the modest profits from merchandising. Some electric service companies which merchandise appliances have a policy in advertising or circularizing of not specifying the make of machine they handle exclusively, but they promote the use of irons, vacuum cleaners, washing machines or electric refrigerators as the case may be. Where the utility company advertises specifically the make of machine it merchandises exclusively, and where the company sends out salesmen to canvass or actively sells the appliances in question there necessarily arises a feeling of antagonism on the part of local electrical dealers and distributors. They have a feeling that when the electric service company profits from the sale of current used by the appliances they sell the electric service company should not act as a competitor to those efforts.

Is it wise for the electric service company at this

stage of the development of electric refrigeration actively to compete by acting as an exclusive distributor for some one make of machine?

Electric refrigeration for the past few years has been and must for some time to come be a pioneering proposition. This means that manufacturers and distributors need the friendly advice, suggestions and co-operation from central stations to assist them over the hardships of getting a permanent footing—otherwise in such a pioneering period the industry may be harmed through many orphan machines in the hands of the public. (By orphan machines we mean any machine the manufacturer or distributor of which has been compelled to give up business with resulting difficulty to users in obtaining repair parts or in obtaining service.) This will come about through central stations that merchandise insisting on, and through pressure obtaining, a larger percentage than other dealers receive. It is only human for a merchandising manager to want to show a profit and accordingly to select the make of machine giving the largest percentage, rather than the most durable product.

CAREFULLY TRAINED SALESMEN REQUIRED

Pioneering requires a specialized type of salesman, well trained, carefully coached and intelligently supervised. The sale of domestic electric refrigerators is not at all comparable to the merchandising of electric irons, vacuum cleaners or even washing machines. It can rarely be successfully handled by the same men. For the most rapid advancement of domestic refrigeration it should be made to appeal to business men who are well financed and experienced in specialty selling.

Some electric service companies have also found that the ice plant and the cold storage men have raised a vigorous protest against the power companies actively merchandising items which interfere with their business.

Power companies should carefully consider the fact that one sales group alone—their own—is not likely to sell as many electric refrigerators in a given period as several strong, independent and specialized sales organizations competing, advertising and talking electric refrigeration in a given territory. A free field for all will result in the most rapid expansion of electric refrigeration.

The merchandising by electric service companies generally will stifle and retard the growth of this new industry, the various parts of which are struggling to become established because of their newness. It has taken many years of hard work on the part of the engineers, manufacturers, distributors and dealers to gain popular acceptance of electric refrigeration as efficient, economical and dependable. Now that this has been accomplished the central stations would do well to co-operate with these men that have been responsible for the development of the industry to its present position; they would do well to counsel with them and benefit from their experience and suggestions. There is a real danger that the heads of the merchandising departments of some electric service companies, with their heads filled with many other problems, may undertake the merchandising of electric refrigeration and through lack of information or indifference to the lessons taught by the history of electric refrigeration may start their business on unsound policies that will later rise to plague central stations as well as the refrigeration industry. This has already occurred, inasmuch as some electric service companies in certain communities are offering unlimited service gratis and are also offering to carry the accounts of purchasers of electric refrigeration for two or three years without interest. Such over-zealousness must result in inevitable harm as the penalty for unbusinesslike methods. The rapid growth of electric refrigeration is a tribute to the manufacturers and distributing organizations that have put it in its present position. Is it not the part of wisdom, at least for some little time in the future, to co-operate with these men and these organizations rather than to compete with them and oppose them?

Some executives argue that there is no difference between the competition of an electric service company and that of another manufacturer. In one way this is true. There is another aspect, however, which they do not consider. That is that the salesman of a public service company in representing that company in the sale of appliances like electric refrigerators frequently makes statements and goes to lengths in order to effect a sale that the officers of that company should not sanction. Frequently these clever salesmen presume upon their representation to make most unwarranted assertions. There have been instances where salesmen of power companies have made threats of lack of service, delayed meter installations and otherwise annoyed those persons who have purchased some make of electric refrigerator other than that sold by that particular power company.

The more constructive attitude for an electric service company to assume today is to regard itself as a super-sales manager for electric refrigeration. This means practical co-operation with the existing refrigerator dealers and the use of intelligent advertising to help stimulate and increase the market.

In the second place the electric service company should definitely and in detail work with the manufacturers and local dealers in the stimulating of interest in electric refrigeration, and should be assisting manufacturers and dealers in the increase of the number of users on its lines.

HOW ELECTRIC SERVICE COMPANIES CAN CO-OPERATE

1. In advancing the idea of electric refrigeration by showing its advantages, economy and dependability.

2. Through the distribution of folders and pamphlets to its customers, and through general advertising of the use of electric refrigeration without necessarily specifying any particular make.

3. By showing on the display floors suitable models of electric refrigeration, giving the various uses and types.

4. Electric service companies should recommend only those electric refrigerators which have been thoroughly tested, are produced by a reputable and well-financed manufacturer who has had at least a year or two of satisfactory manufacture on a quantity basis (which is necessary for interchangeability of parts) and who is backed up by a local service organization of repute with at least a year's experience in servicing a minimum of a few hundred machines in the homes of users.

5. Through favorable meter rates, either by the installation of a power meter and a lower charge per kilowatt for power consumped, or by the use of a special meter or sliding scale basis of charge, whereby the extra consumption of current through the use of mechanical refrigeration is paid for at a lower rate.

Crawford Avenue Station

Designed to Operate as Part of a Superpower Pool—Expected to Effect Great Fuel Economy—Interesting Because of the Boilers, Turbines and Steam Pressure Employed, Accessibility and Simplicity and for the Method of Utilizing Steam to Secure the Economy Planned

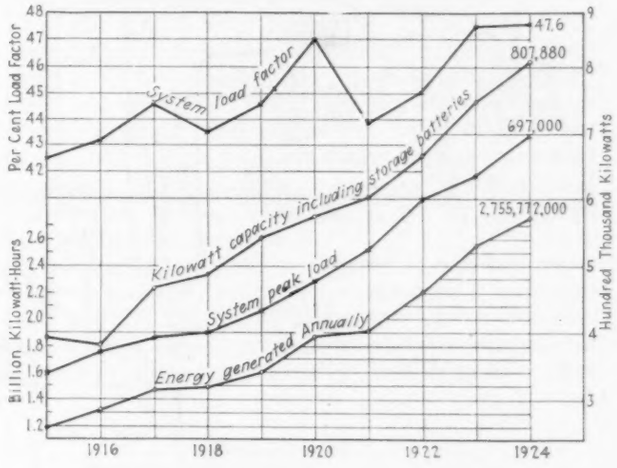
By W. L. ABBOTT
Chief Operating Engineer Commonwealth Edison Company

NO GENERATING station, particularly one for serving a large load, can be located, designed and operated for the most reliable and economical performance throughout its period of usefulness without careful consideration of the rate of growth of system load, its nature, the trend of the load center, the physical and operating relations of the plant to other plants in the same and adjacent systems, and the availability of fuel and water. With increasing interconnection of stations and systems, there is less justification than ever of designing individual stations as though their operation depended solely on their own characteristics. No matter how large individually, interconnected stations with heavy tie-lines are virtually becoming units of what might be considered a mammoth generating station spread over considerable territory in which the tie-lines virtually represent extension of buses.

Depending chiefly on the separation of the stations and the dependability of the tie-lines, therefore, the design and operation of the component plants in an interconnected system are largely the same as though all individual generators were in one station. The larger the total load and the stronger the interconnecting ties, the larger the rating individual generator units can safely have, the greater the dependence that can be placed on system reserve as distinguished from station reserve, and the more completely can loads be concentrated on the more efficient plants. Coupled with this expanding opportunity to design individual plants as units of a mammoth generating system, however, are equally expanded problems of controlling the concentration of power thus made available, which somewhat modifies the picture.

The foregoing comments apply to the new Crawford Avenue station of the Commonwealth Edison Company, which was formally opened on May 26 with three units totaling 160,000 kw. in operation. The need for this station is indicated by the fact that the annual system peak load has been increasing very rapidly, the peak load attaining a value of 697,000 kw. in December, 1924. The yearly consumption of 2,787,090,000 kw.-hr. for Chicago alone in 1924 is larger than for any state outside of Illinois, New York, Pennsylvania and Ohio, represents an increase of 8.3 per cent over 1923, and was developed at a load factor of 47.6 per cent. On a unit basis the consumption was 845 kw.-hr. per year per capita, compared with 518 for the United States.

The energy sold in 1924 was distributed to other utilities, large power, domestic, commercial and small retail power customers in about the following proportions: 40, 33, 12, 12, 3 per cent respectively. Compared with 1923, the growth in domestic consumption showed the greatest percentage increase (20.8 per cent), the growth of wholesale low-tension alternating-current consumption and commercial consumption ranking next in percentage, being 16.7 and 12.3 per cent respectively. The street and elevated railways consumed the most energy of utilities to which power was sold in 1924 (nearly 831,500,000 kw.-hr.). Of the other large power users the following groups stand out for energy consumption: Steel mills, about 95,500,000 kw.-hr., packing plants, nearly 84,700,000 kw.-hr.; manufacturers, more than 78,700,000 kw.-hr.; Chicago pumping, etc., more than 70,000,000 kw.-hr.; office buildings, more than 32,000,000 kw.-hr.; department stores, more than

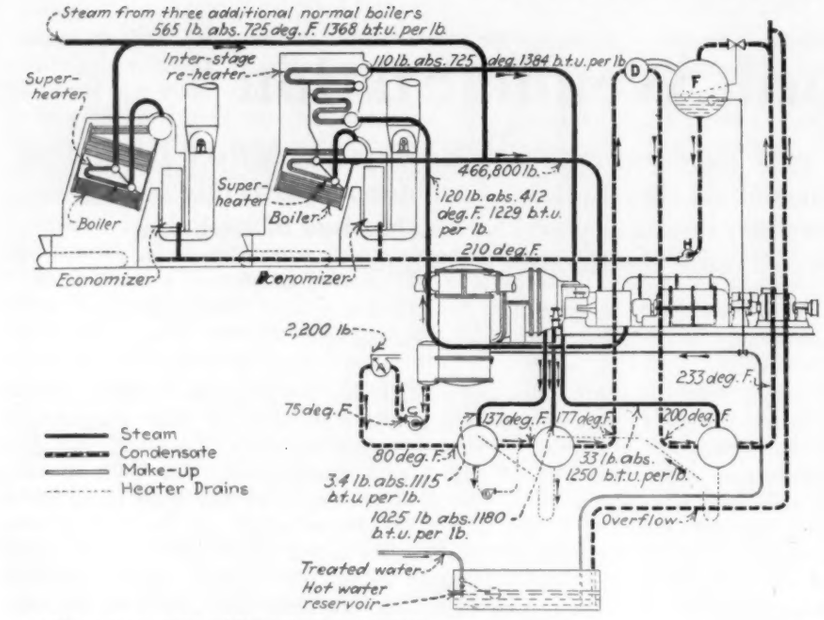


GROWTH OF SYSTEM PEAK, ANNUAL CONSUMPTION, LOAD FACTOR AND GENERATING CAPACITY

25,300,000 kw.-hr.; newspapers and printing, more than 12,750,000 kw.-hr.

The contract to supply power for the Illinois Central electrification will demand 30,000 hp. with an energy consumption of probably 67,000,000 kw.-hr. the first year (1926), increasing possibly to 112,000,000 kw.-hr. by 1940. The Edison company has other large railroad customers, the new Union Station calling for about 18,000,000 kw.-hr. the first year.

Generating and storage battery capacity for serving the Chicago system at the end of 1924 was approximately 810,000 kw., divided among generating stations, of which Calumet, Northwest, Fisk Street and Quarry Street stations are outstanding. Not only are all these stations interconnected by strong electrical ties, but 132,000-volt trunk lines have been built to the city limits from Waukegan, Ill.; Michigan City, Ind., and Joliet, Ill., and will eventually loop around the city and permit interchange of power with plants at the points mentioned as well as with interconnected systems. Already plans are projected for power plants at the Indiana-Illinois state line on Lake Michigan and at



STEAM AND CONDENSATE FLOW DIAGRAMS FOR THREE TYPES OF UNITS USED. COURSE OF STEAM THROUGH TURBINES, REHEAT BOILERS AND FEED-WATER HEATERS; ALSO PATH OF CONDENSATE, DRAINS, ETC.

Five Boilers Per Unit

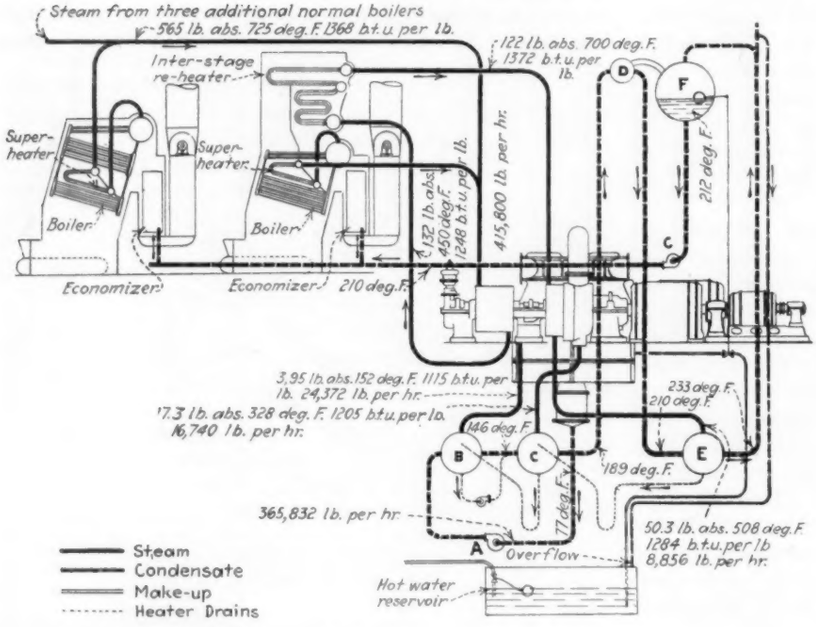
FOUR NORMAL BOILERS

Boiler	16,615 sq.ft.
Superheater	2,700 sq.ft.
Economizer	11,054 sq.ft.

ONE REHEAT BOILER

Boiler	6,000 sq.ft.
Superheater	1,700 sq.ft.
Economizer	11,054 sq.ft.
Reheater	14,000 sq.ft.

A—Ejector steam condenser.
B—Low pressure extraction heater.
C—Intermediate pressure extraction heater.
D—De-aerator vapor condenser.
E—High pressure extraction heater.
F—De-aerator.
G—Motor-driven condensate pump.
H—Motor-driven feed pump.


Steam from three additional normal boilers
565 lb. abs. 725 deg. F. 1368 b.t.u. per lb.
Inter-stage re-heater
122 lb. abs. 700 deg. F. 1372 b.t.u. per lb.
Super-heater
Super-heater
Boiler
Boiler
132 lb. abs. 450 deg. F. 1248 b.t.u. per lb.
415,800 lb. per hr.
212 deg. F.
Economizer
Economizer
210 deg. F.
3.95 lb. abs. 152 deg. F. 1115 b.t.u. per lb. 24,372 lb. per hr.
17.3 lb. abs. 328 deg. F. 1205 b.t.u. per lb. 16,740 lb. per hr.
233 deg. F.
210 deg. F.
146 deg. F.
189 deg. F.
77 deg. F.
365,832 lb. per hr.
50.3 lb. abs. 508 deg. F. 1284 b.t.u. per lb 8,856 lb. per hr.
Overflow
Hot water reservoir
Steam
Condensate
Make-up
Heater Drains

Five Boilers Per Unit

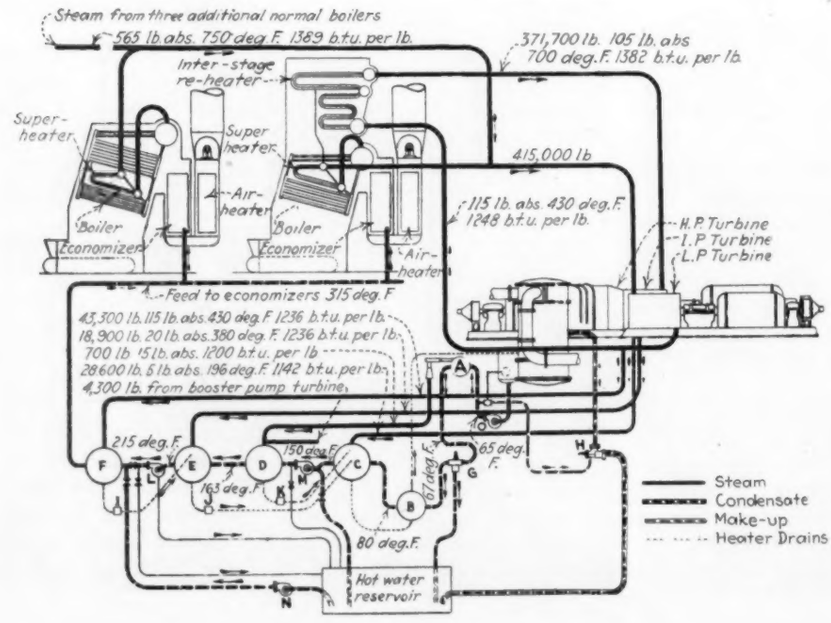
FOUR NORMAL BOILERS

Boiler	16,615 sq.ft.
Superheater	2,700 sq.ft.
Economizer	11,054 sq.ft.

ONE REHEAT BOILER

Boiler	6,007 sq.ft.
Superheater	1,700 sq.ft.
Economizer	11,054 sq.ft.
Reheater	14,000 sq.ft.

A—Motor-driven condensate pump.
B—Low pressure extraction heater.
C—Intermediate pressure extraction heater.
D—De-aerator vapor condenser.
E—High pressure extraction heater.
F—De-aerator.
G—Motor-driven feed pump.


Steam from three additional normal boilers
565 lb. abs. 750 deg. F. 1389 b.t.u. per lb.
371,700 lb. 105 lb. abs 700 deg. F. 1382 b.t.u. per lb.
Inter-stage re-heater
Super-heater
Super heater
415,000 lb
Air-heater
115 lb. abs. 430 deg. F. 1248 b.t.u. per lb.
Boiler
Boiler
H.P. Turbine
I.P. Turbine
L.P. Turbine
Economizer
Economizer
Air-heater
Feed to economizers 315 deg. F
43,300 lb. 115 lb. abs. 430 deg. F. 1236 b.t.u. per lb.
18,900 lb. 20 lb. abs. 380 deg. F. 1236 b.t.u. per lb.
700 lb 15 lb. abs. 1200 b.t.u. per lb
28600 lb. 5 lb. abs. 196 deg. F. 1142 b.t.u. per lb.
4,300 lb. from booster pump turbine.
215 deg. F.
150 deg. F.
65 deg. F.
67 deg. F.
163 deg. F.
80 deg. F.
Hot water reservoir
Steam
Condensate
Make-up
Heater Drains

Five Boilers Per Unit

FOUR NORMAL BOILERS

Boiler	16,615 sq.ft.
Superheater	2,700 sq.ft.
Economizer	11,054 sq.ft.
Air-heater	10,000 sq.ft.

ONE REHEAT BOILER

Boiler	6,000 sq.ft.
Superheater	1,700 sq.ft.
Economizer	11,054 sq.ft.
Air-heater	10,000 sq.ft.
Reheater	14,000 sq.ft.

A—Ejector steam condenser.
B—Drain cooler.
C—Low pressure extraction heater.
D—Booster heater.
E—Intermediate pressure extraction heater.
F—High pressure extraction heater.
G—Overflow relief valve.
H—Make-up admission valve.
I, J, K—Drainage traps.
L—Motor-driven feed pump.
M—Steam-driven booster pump.
N—Standby steam-driven feed pump.
O—Motor-driven condensate pump.

Michigan City that will equal or exceed the Crawford Avenue station in capacity.

Despite this concentration of power generation and opportunities for taking advantage of all the benefits of interconnection, the rapidly increasing load in Chicago called for the erection of the new Crawford Avenue station with an initial capacity of 160,000 kw., which will be raised to 750,000 kw. and probably 1,000,000 kw. eventually. A 75,000-kw. turbine group, which is now on order, will make the fourth unit and bring the installed capacity up to 235,000 kw.

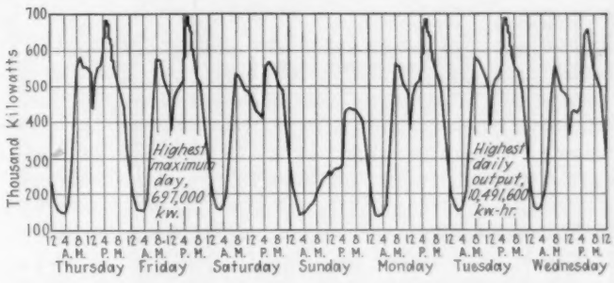
The site selected for the station is on the Chicago Drainage Canal, near 35th Street and Crawford Avenue, about four and one-half miles south of Chicago's load center, convenient to numerous rail facilities for receiving coal and adjacent to ample condensing water for several times the immediately projected capacity. The site is thirteen and one-half miles from the farthest point of the northern city limits and sixteen miles from the farthest point of the southern limits. About 54 per cent of the company's load is north of it and 46 per cent south. Even with the flow of the Chicago Drainage Canal restricted to 4,167 sec.-ft., there will be ample circulating water for condensing purposes to permit building a station of about 2,000,000 kw. based on a steam consumption rate of 9 lb. per kilowatt-hour.

Coal Supply and Storage Facilities

From about 54,000 acres of coal rights in the Illinois and Indiana bituminous field, containing an estimated recovery of 407,000,000 tons (purchased by the Commonwealth Edison Company to safeguard supply and price paid), and transported over the numerous rail routes entering Chicago, the new plant is in an excellent position to receive an uninterrupted supply of fuel. Space for about 300,000 tons storage is provided just southwest of Chicago in addition to storage at the individual stations. Delivery of fuel is also facilitated by a company railroad line having connections with six trunkline railroads through the belt-line railroad of Chicago. Another feature of the Crawford Avenue site is that it is immediately adjacent to one of the chief gas-producing plants of the Peoples Gas Light & Coke Company, so that if it ever becomes feasible to operate generating stations on byproducts from the gas plant, it will be practical to do so.

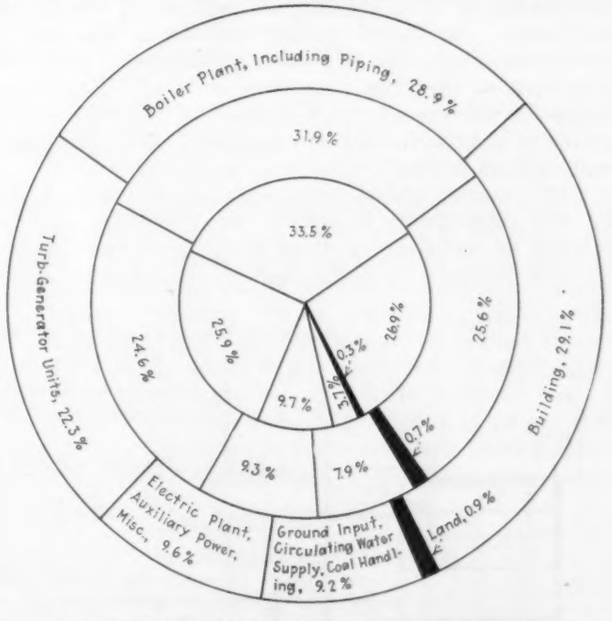
In designing the Crawford Avenue station, as with any modern station nowadays, the urge was to obtain the utmost reliability and the highest fuel economy consistent with the fixed charges on the investment made necessary. Fuel economy has become increasingly important, because fuel expense constitutes the greater portion of the energy-production expense (approximately 80 per cent), because nearly 3,000,000 tons of coal was consumed by the Commonwealth Edison Company in 1924, and because the tendency of fuel to increase in price would increase the unit fuel expense still more unless economies were effected. Although the fuel consumption of 1924 was 22½ per cent less than would have been required if the total power output had been produced by the system that obtained in 1914 (namely, 2.8 lb. of coal per kilowatt-hour), it is desired to bring down the rate of fuel consumption in this new station (which will operate as nearly on base load as possible) to 1.5 lb. of coal per kilowatt-hour based on 10,000 B.t.u. coal. This is what the design is expected to accomplish; its effectiveness will be proved after the plant has been in operation a while. By this accomplishment the Crawford Avenue station, with four units installed having a total rating of 235,000 kw., will be able to generate about 1¼ billion kilowatt-hours a year with a coal consumption of 930,000 tons, or an economy that would mean a saving of almost a million tons a year if all of the output could be generated in plants of the Crawford Avenue character. Although many factors will contribute to this accomplishment, it is sought chiefly through the use of large units, higher steam pressures and temperatures, reheating of the steam after it has expanded in the high-pressure stages, extracting steam from the low-pressure stages to heat feed water after it has done work in the higher stages, and by the design of the boilers and furnaces.

As previously indicated, the supply of coal and water will never place a limitation on any rating now considered for the Crawford Avenue station or, for that matter, several times the ultimate rating. The size of plant will be determined more by the ability to control


Thousand Kilowatts
700
600
500
400
300
200
100
Highest maximum day, 697,000 kw.
Highest daily output, 10,491,600 kw-hr.
12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12 4 8 12
A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M. A.M. P.M.
Thursday Friday Saturday Sunday Monday Tuesday Wednesday

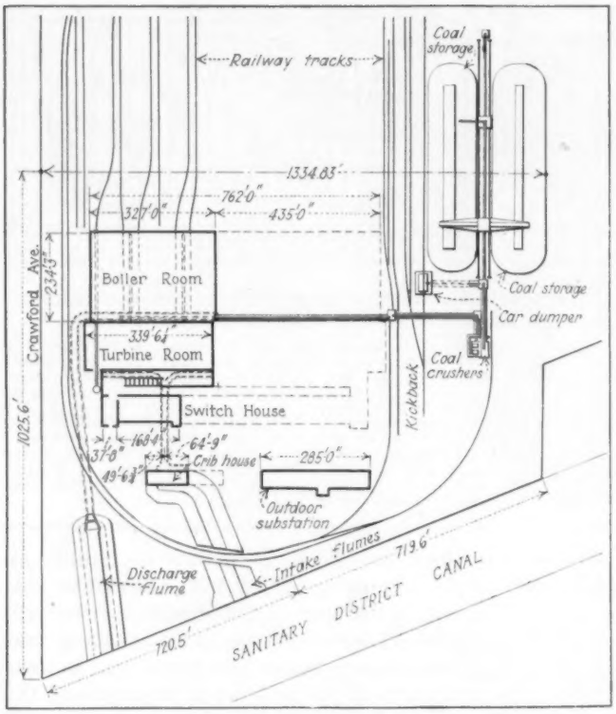
CHARACTERISTIC WEEKLY LOAD CURVE OF COMMONWEALTH EDISON COMPANY FOR WEEK OF SYSTEM MAXIMA

A load diagram of total system for the seven days preceding Christmas, which seven days include the day of the highest maximum to date and the day of the greatest twenty-four-hour output on record. On December 19, 1924, the output maximum reached the highest in the history of the company, being 697,000 kilowatts. This is an increase over the maximum kilowatt of 1923 of 62,000 kw. or an increase of 9.8 per cent. On December 23 a new record for twenty-four-hour output was established, the figure being 10,491,000 kw.-hr. This figure exceeds the output for the entire year of 1893 (the World's Fair Year), the first year in which the annual output exceeded the 10,000,000 mark.



HOW EACH DOLLAR INVESTED IS DISTRIBUTED

The outer ring refers to distribution based on three units totaling 160,000 kw. The next ring refers to distribution based on four units totaling 235,000 kw. The inner ring refers to distribution based on 750,000 kw. capacity. The station equipped with 160,000 kw. cost $22,000,000 and with 1,000,000 kw. installed it will be nearly $100,000,000, making the unit cost per kilowatt installed reduce from $137.50 per kw. to about $100 per kw. by concentrating so much capacity in one station.



PORTION OF PLANT SITE, SHOWING ARRANGEMENTS FOR RECEIVING AND HANDLING CONDENSING WATER, FUEL AND EQUIPMENT

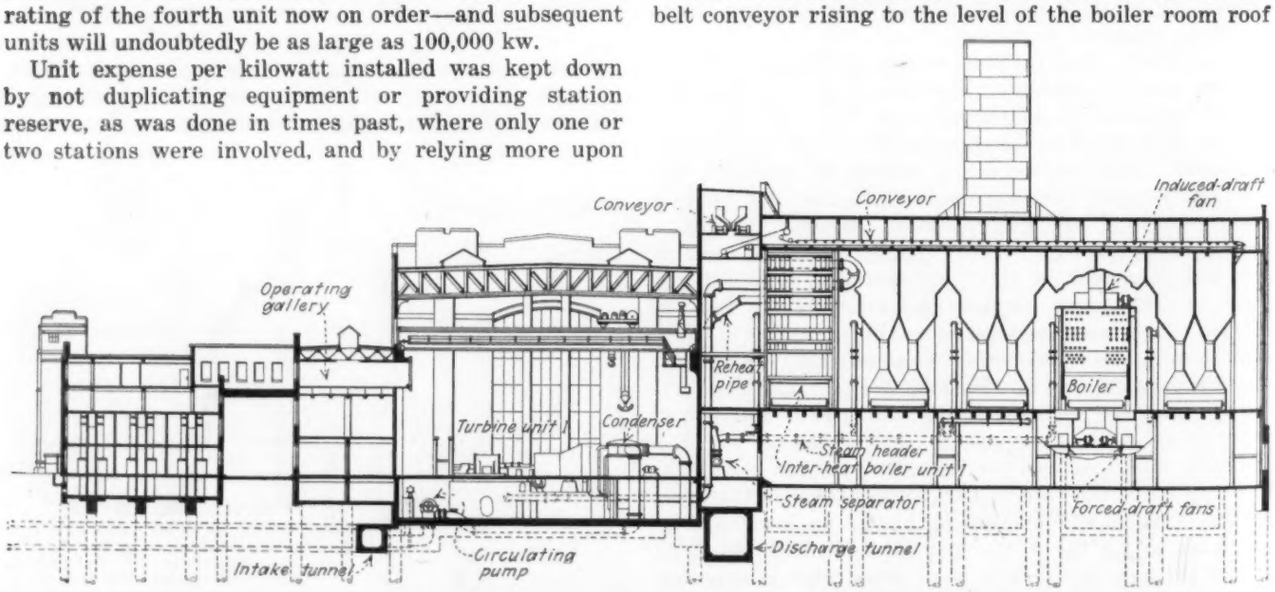
concentrated power production, by tie-line reliability, by the building of other plants in other parts of the interconnected district and by future facilities for reliable interchange of power with adjacent districts. Neither was the size of individual unit groups limited, as in the olden days, to a certain percentage of the station rating, because of the reason outlined at the outset of this article—namely, that Chicago's entire pool of power can be called upon for reserve in an emergency, so that the outage of even the largest unit would hardly be noticeable. The size of the units was largely determined by the size that could be reasonably depended upon for operation at the time they were ordered. Even this limitation has risen from 50,000 kw. to 75,000 kw.—the rating of the fourth unit now on order—and subsequent units will undoubtedly be as large as 100,000 kw.

Unit expense per kilowatt installed was kept down by not duplicating equipment or providing station reserve, as was done in times past, where only one or two stations were involved, and by relying more upon the interconnected capacity of which the Crawford Avenue station is only a part.

The station property comprises seventy-two acres, on one corner of which is the generating station with its switch house next to the drainage canal and the turbine room and boiler room next in order. This arrangement permits relatively short intake and discharge tunnel connections with the drainage canal for condenser circulating water, leaves all parts of the plant accessible to rail facilities, permits extension of the plant to the east, and places the boiler room with any future extensions in desirable relation to coal storage and handling facilities. The turbine room and boiler room are laid out on a unit basis—that is, with each turbine group and its complement of boilers in line. The present section is laid out for four units, three of which are installed and operating, preparations being made for the fourth unit. The coal-handling facilities have been laid out so that none of them will have to be changed as the plant is extended. Everything is laid out for accessibility and ease in handling equipment, more than the usual amount of space being provided around equipment.

Coal may be received over six main trunk lines through the medium of the Chicago belt line and the company's own railroad. Cars containing coal are pushed onto a car dumper, where they are weighed full, dumped into a hopper and weighed again empty. As each car is pushed onto the dumper the preceding car is pushed off onto a gravity track and shunted by an automatic switch onto a "kickback" for removal. From the hopper of the car dumper the coal passes onto a belt conveyor delivering either to breakers for sizing and immediate use, or to the storage pile in the yard. Storage coal is transferred by a long conveyor running out into the coal yard and delivering to a tripper and stacker, which distributes the coal in storage stacks on each side. Space is now set aside for about 100,000 tons storage, although more can be provided if necessary. To reclaim coal from storage, it is picked up by a grab bucket on a gantry crane and placed on the storage conveyor, which is then operated in the reverse direction to deliver coal to the breakers.

Coal from the breakers is discharged to an inclined belt conveyor rising to the level of the boiler room roof

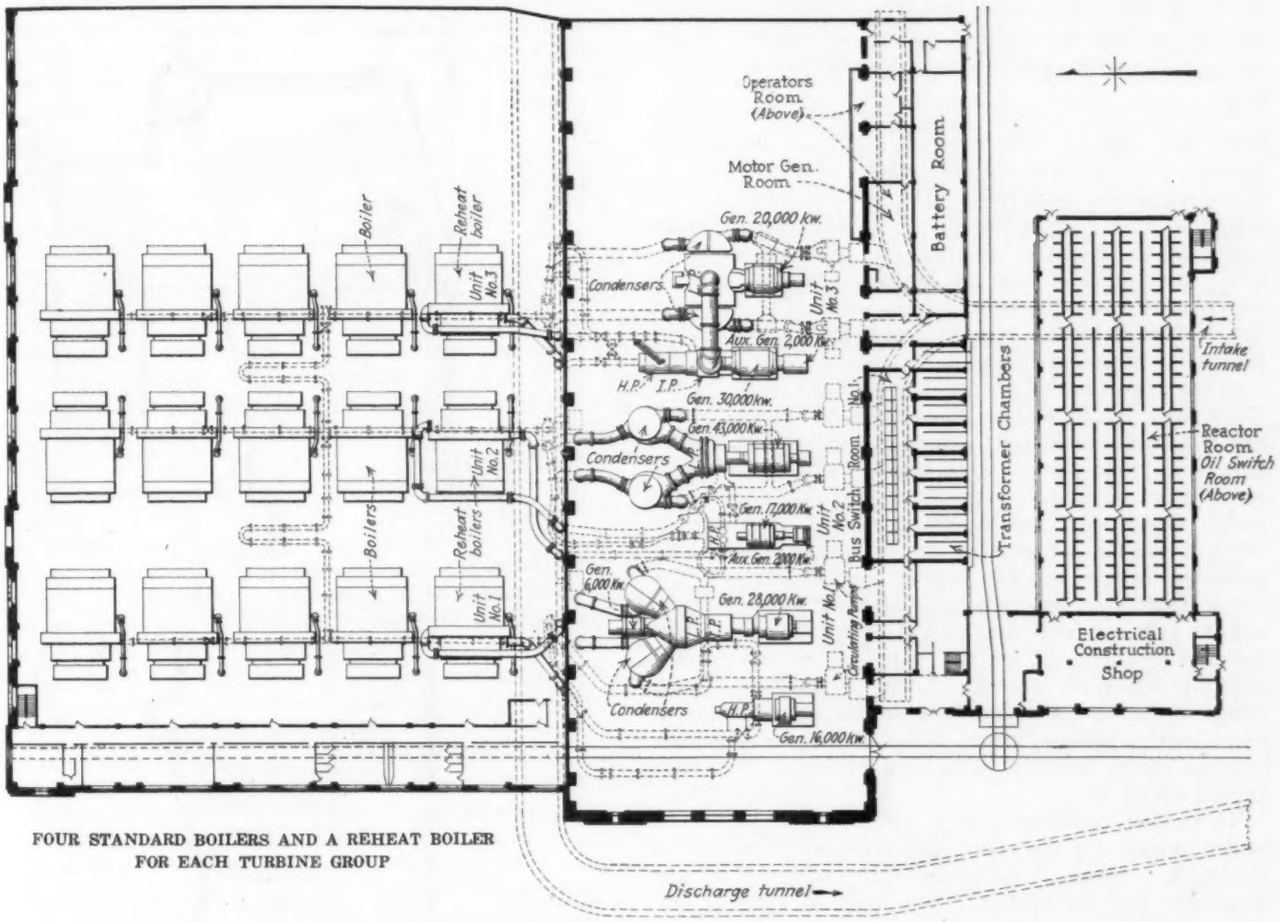


CROSS-SECTION THROUGH CRAWFORD AVENUE STATION

Note that reheat boiler for each unit group is nearest turbine; also the use of vertical condensers.

at the end of the ultimate station and conveyed along a horizontal belt conveyor running the entire length of the boiler house. At right angles to this conveyor above the firing aisles are cross-conveyors upon which the coal may be dumped for distribution to the bunkers, whence it is discharged by gravity through chutes onto the stokers. The capacity of the bunkers is 250 tons (twenty-four hours supply) per boiler and that of the conveyors feeding into the building is 400 tons per hour. If necessary for the ultimate station, a second

The reheat boilers, which are placed near the turbines to minimize the length of reheat piping, each contain 14,000 sq.ft. of reheating surface to raise the temperature of the exhaust from the high-pressure element of the turbine before it enters the lower-pressure element. In addition to reheat surface, there is 6,000 sq.ft. of water-heating surface and 1,700 sq.ft. of superheater surface, primarily to reduce the temperature of the gases to less than 1,700 deg. before they reach the reheating surface and incidentally to make steam. As



FOUR STANDARD BOILERS AND A REHEAT BOILER FOR EACH TURBINE GROUP

conveyor can be easily installed. The entire coal plant is operated by 440-volt, three-phase, sixty-cycle motors.

Each turbine group is supplied with steam from four standard boilers and one reheat boiler, arranged in a single row along the center line of the turbine group. The standard boilers are designed for 650-lb. (maximum) pressure with a total temperature, including superheat, of 750 deg. F., but are operated at 575 lb. Each has 16,615 sq.ft. of water-heating surface, 2,700 sq.ft. of superheater surface and 11,054 sq.ft. of economizer surface. At maximum capacity, the boilers will generate 150,000 lb. of steam per hour. As indicated by the accompanying illustration, these boilers are of the steel-cased, cross-drum, inclined water-tube Babcock & Wilcox type, with two decks of tubes and a superheater between. The lower deck, which is eight tubes high and forty sections wide, consists of 3¼-in. tubes, the lower tubes being spaced to absorb the radiant heat of the furnace and reduce adherence of slag. The upper deck is seventeen tubes high by forty sections wide and consists of 2-in. tubes; baffle extends across this deck to make the gases pass the tubes twice.

shown by the accompanying illustration, the reheating surface consists of 2-in. tubes mounted at the top of the boiler. The stoker under each reheat boiler will be operated so as to regulate the temperature of the steam leaving the reheater. In an emergency, doors in the front of the reheater furnaces can be opened to cool the interstage superheaters above the water-heating and superheater surface. The boilers under the reheaters will generate about 65 per cent to 70 per cent as much steam as each of the standard boilers, being so proportioned that the furnaces are the same under all boilers.

Water economizers, having 11,054 sq.ft. of heating surface in 2-in. tubes, are mounted back of each boiler and in the same casing therewith. One group of boilers —that serving the C. A. Parsons turbine group—will also be equipped with air economizers owing to the higher steam extraction temperature employed for feed-water heating.

Chain-grate stokers driven by direct-current motors are used on all boilers. Five of the stokers are B. & W., having 444 sq.ft. of effective area; five are Coxe stokers

and five Illinois stokers, the two latter makes having 423 sq.ft. of heating surface apiece.

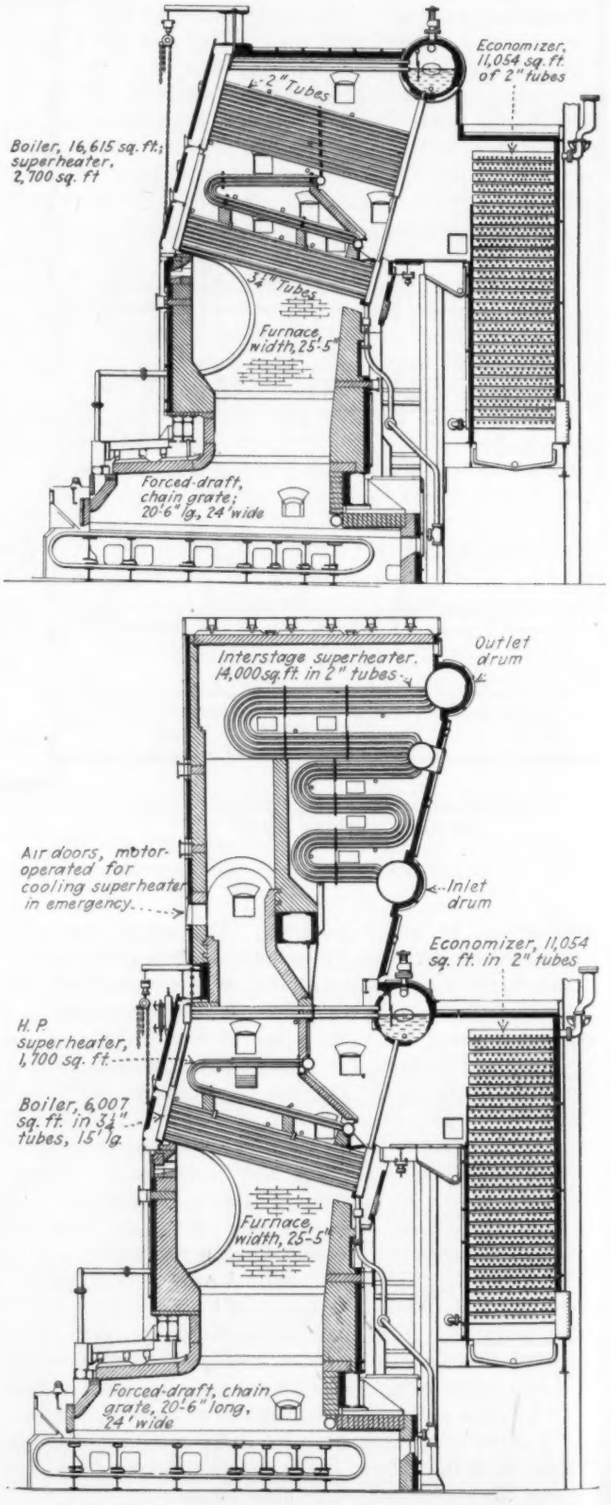
Handling of ashes and avoidance of fumes therefrom are facilitated by the ash-disposal method used. The ashes are dumped from the rear end of the stokers through chutes, which discharge into pits filled with water, located below the basement floor. The walls of the chutes extend below the water level, thereby providing a water seal against outside air entering the furnaces through the chutes. The water in the pits also quenches the ashes, and the pits provide temporary storage for the ash until it can be transferred to ash cars by the grab-bucket cranes running over the ash pits.

Draft in the furnaces is supported by two forced-draft fans and one induced-draft fan per furnace, supplemented by brick-lined steel stacks extending 150 ft. above the boiler room floor. The two forced-draft fans are sufficient for supplying air to maintain the maximum rating of the furnaces and one fan will carry a boiler at a rating of about 100,000 lb. of steam per hour. To assure complete combustion of the gases distilled from the coal and reduce combustion chamber volume by producing turbulence therein, secondary air is admitted over the grates under pressure by two auxiliary forced-draft fans per furnace. Duplication of induced draft has not been considered necessary, because draft fans have been found very reliable, two being used for forced draft only to enable cutting out one fan at reduced loads. Cross-connected air ducts are not provided between furnaces for emergency supply, as they cause excessive leakage and are seldom if ever needed. The forced-draft fans are rated at 40,000 cu.ft. per minute and the induced-draft fans at 115,000 cu.ft. per minute, the former being driven by 25-hp., 2,300-volt motors and the latter by 225-hp., 2,300-volt motors. Each group of boilers is normally operated as a unit with its respective turbine group, although cross-connections between steam headers have been provided to permit flexible operation.

No radical provisions were made in the piping or valves to care for the steam pressure and temperature employed. Plenty of opportunity is afforded for pipe expansion and contraction. The vertical runs of the reheat piping are anchored on a pivot at the same elevation as the corresponding turbine shaft to prevent end-thrust on the turbines. In connection with one turbine four pipes instead of one are used to lead the steam to the high-pressure unit to obtain greater flexibility. Sargol welded joints are used throughout for high-pressure piping and the valves have heat-treated cast-steel bodies with Monel-fitted valve seats.

Three distinctly different types of turbine groups, representing the latest thought in practice in turbine design, are employed, all being compound units. Three makes were selected, primarily to secure prompt delivery and furnish experience that will indicate which principles of design and operation are most desirable. Interchangeability of parts and greater familiarity of operators with units, which are advantages obtainable with similar units, were considered of secondary importance in this particular plant. A feature common to all of the unit groups is the delivery of 550-lb. steam at 725 deg. F. to the high-pressure throttles, the use of two vertical condensers with each low-pressure element to enable efficient steam connection and reduce basement height, and the employment of reheaters and steam extraction for feed-water heating.

The C. A. Parsons turbine group, which is a three-spindle, single-flow, 50,000-kw. set, has the intermediate and low-pressure elements in tandem. Each of the three elements drives separate generators rated at 15,500, 28,500 and 6,000 kw. respectively. The high-pressure element exhausts at 430 deg. F. and 115 lb. (absolute) pressure to the corresponding reheat boiler, where the temperature is raised to 700 deg. F. and the steam delivered to the intermediate-pressure element at 105 lb. pressure (absolute). Both the high- and intermediate-


Economizer, 11,054 sq. ft. of 2" tubes
2" Tubes
Boiler, 16,615 sq. ft.; superheater, 2,700 sq. ft
3¼" Tubes
Furnace, width, 25'-5"
Forced-draft, chain grate; 20'-6" lg., 24' wide
Interstage superheater, 14,000 sq. ft. in 2" tubes
Outlet drum
Air doors, motor-operated for cooling superheater in emergency
Inlet drum
Economizer, 11,054 sq. ft. in 2" tubes
H. P. superheater, 1,700 sq. ft.
Boiler, 6,007 sq. ft. in 3¼" tubes, 15' lg.
Furnace, width, 25'-5"
Forced-draft, chain grate, 20'-6" long, 24' wide

CROSS-SECTIONS OF NORMAL AND REHEAT BOILERS

pressure elements operate at 1,800 r.p.m. and the low-pressure element at 720 r.p.m. Each generator has its own direct-connected exciter.

The 60,000-kw. General Electric turbine group has two separate shafts with impulse blading throughout, the high-pressure turbine being rated at 17,000 kw., 1,800 r.p.m. and the low-pressure at 43,000 kw., 1,200 r.p.m. The high-pressure element exhausts steam at 120 lb. (absolute) and 412 deg. F. into the reheat boiler, which raises the temperature to 725 deg. F. and delivers the steam to the low-pressure element at 110 lb. (absolute). Mounted on the shaft of the high-pressure element is a 2,000-kw., 2,300-volt generator supplying power for auxiliary machinery; the shaft of the low-pressure element carries a direct-current generator for exciting the fields of both generators.

The 50,000-kw. Westinghouse turbine group is a two-spindle, three-element set with reaction blading throughout, except for the first high-pressure wheel, which has impulse blading. The high and intermediate-pressure stages are on one shaft driving a 30,000-kw. generator, and the low-pressure element, which is of the double-flow type, drives a 20,000-kw. generator. Both spindles operate at 1,800 r.p.m. The high-pressure element discharges steam at 132 lb. (absolute), 450 deg. F., to the reheat boiler, which raises the temperature to 700 deg. F. and delivers the steam to the intermediate-pressure element at 122 lb. (absolute). This unit group is also provided with a 2,000-kw. auxiliary generator and one exciter for both generators.

Provisions are made so that in case the intermediate or low-pressure turbine-generators should lose their load when the high-pressure throttle is open, the high-pressure units will exhaust to atmosphere in the case of units Nos. 1 and 2 and to the condenser in the case of unit No. 3. Under such circumstances the emergency doors on the reheat boiler can be opened to prevent overheating and the stoker slowed down or stopped.

Heating of feed water is secured by extracting steam from the turbines at three points, the Parsons turbine heating feed water to 315 deg. F., the General Electric and Westinghouse units to 210 deg. F. Used with the C. A. Parsons unit group are four feed-water heaters, the high-pressure extraction heater receiving steam at 115 lb. (absolute), the intermediate-pressure at 20 lb. (absolute) and the low-pressure at 5 lb. (absolute). The fourth unit is a booster pump heater receiving steam at 15 lb. (absolute). With the General Electric unit group three extraction heaters are used, the high-pressure unit receiving steam at 33 lb. (absolute), the intermediate at 10.25 lb. (absolute) and the low at 3.4 lb. (absolute). Three heaters are also used with the Westinghouse unit group, the high-pressure receiving steam at 50.3 lb. (absolute), the intermediate at 17.3 lb. (absolute) and the low at 3.95 lb. (absolute).

Exhaust steam from each low-pressure element discharges into two vertical condensers attached to the sides of the elements and extending downward into the basement. Each condenser contains 1-in. tubes 19 ft. long, the cooling surface on the Worthington condenser used with the General Electric unit being 75,000 sq.ft., that on the Westinghouse condenser 65,000 sq.ft., and that on the C. A. Parsons condenser 56,000 sq.ft. The latter is not as large as the others, because more steam is extracted for feed-water heating and because more circulating water per unit of condensing surface is used.

The 75,000-kw. unit to be added to the station will be made by the General Electric Company. It will be a cross-compound unit, consisting of a 28,250-kw., 0.85 power-factor generator and a 2,000-kw., 2,300-volt, 60-cycle service generator on the high-pressure element and a 46,750-kw., 0.85 power-factor generator and a direct-connected exciter in the low-pressure element. The high-pressure unit will operate at 1,800 r.p.m. and will take steam at 550 lb. gage and 750 deg. F. total temperature. It will exhaust at 95 lb. gage to the low-pressure element, which will operate at 1,200 r.p.m. As in the case of the previously installed turbine, twin vertical condensers will be used.

As shown by the station site illustration, two flumes 12 ft. square convey water from the Sanitary District Canal into the screen well, where double rotating screens remove the trash and pass the water into a single tunnel, dividing under the turbine room into two branches extending in opposite directions to serve the four turbine groups that will be installed in the first section of the station. Parallel to and under the opposite wall of the turbine room from the intake tunnel is a discharge tunnel 18 ft. high and 16 ft. wide emptying into the Sanitary District Canal downstream from the intake tunnels. The discharge tunnels will provide for a circulation of about 3,500 sec.-ft. of water which will be needed in the completed station.

Two circulating pumps are provided for each set of condensers, those for the Parsons unit and General Electric unit being rated at 40,000 gal. per minute each, and those for the Westinghouse unit 35,000 gal. per minute each. The pumps for the first two turbine groups are operated by motors rated at 350 hp., and those for the third unit group by 300-hp. motors. It may be interesting to note that for every ton of coal burned under the boilers approximately 400 tons of water will be required through the condensers.

For removing air from the condensers, different methods are used for each turbine group. With the Parsons unit, there are six sets of three-stage steam ejectors; with the General Electric unit, there are four two-stage steam jets and four hydraulic vacuum pumps, and with the Westinghouse units, there is one LeBlanc air pump and one bank of steam jets.

Credit is due Sargent & Lundy, Inc., for the design and construction of the steam end of the plant. The electrical end of the plant was handled entirely by the engineering department of the Commonwealth Edison Company.

Post-War Electrical Development in Alsace-Lorraine

THE electrical industry of Alsace-Lorraine, since the war a part of France, pays a much higher wage scale than prevails throughout the rest of the nation. This is considered a handicap, and legislation or regulation to remove it is sought by the producers and distributors of electricity. The electrical companies of Alsace, basing their average wage scale on the rate in vogue at Strasbourg in 1914, have paid an average wage since 1918 which shows an increase of 270 per cent, whereas the increase in the rest of France is but 155 per cent.

Another subject to which the Alsace-Lorraine central-station men are paying attention is the advisability of certificated electricians being the only ones allowed to make wiring installations in private and public buildings. The alternative way would be to forbid installations except by the light and power companies, but this

is hardly thought possible in view of the laws regulating the liberty of commerce. The fact is, however, that shocking examples of wiring—and dangerous ones at that—are to be seen even today throughout France.

The distribution of energy is steadily increasing in Alsace-Lorraine. From 291,000,000 kw.-hr. in 1923 the figure increased to 346,000,000 kw.-hr. in 1924.

The Franco-Swiss agreement with respect to the regulation of the flow of the Rhine River by a dam at Kembs will largely increase the possibilities of production of electrical energy throughout this region, which, it is asserted, will accordingly become that part of France where the use of electricity in industry, in the home and on the farm will see its highest development.

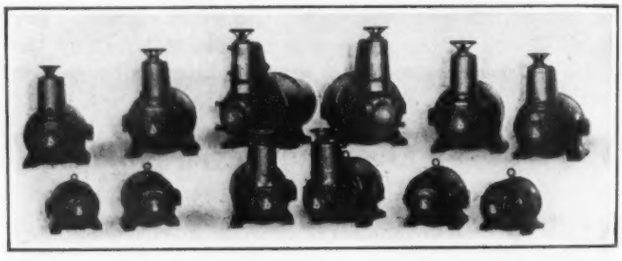
Letters from Our Readers

The Compensated Asynchronous Motor in Europe

To the Editor of the ELECTRICAL WORLD:

In your issue for April 18, page 816, Val. A. Fynn describes a new compensated asynchronous motor. It will be interesting, perhaps, to the readers of the ELECTRICAL WORLD to hear about the development of similar motors during 1922-1925 in Europe.

The principle that underlies all motors of this kind was first enunciated by Alexander Heyland in 1901 (*Elektrotechnische Zeitschrift*, August 8; London *Electrician*, August 16; *L'Industrie Electrique*, September 10; *L'Eclairage, Electrique*, October 26). Heyland explained that an asynchronous motor with unity power factor could be built simply by introducing the exciting current not in the primary part of the motor, but—using a commutator of course—in the secondary part. His motor already possessed most of the constructive details of the motors of today. Some manufacturing companies (A.E.G., Siemens & Halske and others) supplied motors of the new type which proved entirely satisfactory. But it was impossible to introduce the compensated motor into the market. The distribution systems were very small at this time and the wattless



HEYLAND TYPE OF COMPENSATED ASYNCHRONOUS MOTORS

currents were inconsiderable; therefore the normal asynchronous motor, which is very sturdy, was preferred by the customers to the more expensive compensated commutator motor.

Recently the situation changed. The growth of the distribution systems as well as the increase of the lagging currents and the necessity of strictest economy made it desirable to reconsider the question. In November, 1921, a very important meeting of the German electrical power distribution companies was held at Berlin for the sole purpose of discussing the possibilities of improving the power factor. This meeting gave a powerful impulse to the development of suitable electrical motors.

First of all, the compensated asynchronous motor (L. Schüler, Dr. Max Levy in Berlin, 1922) made its appearance. Later on two types of compensated asynchronous motors were designed. The first one (Bergmann, Berlin, spring 1923, Deutsche Werke, and others) corresponds exactly to the old Heyland motor; the other one (Sachsenwerke, autumn 1923, A.E.G.) has the rotor for primary part, the stator for secondary. This motor has the same features as the well known three-phase commutator-shunt motor of the A.S.E.A. (Sweden) and the S.S.W. Some thousands of both kinds of motors are in practical use throughout Germany. The German electrical periodicals have since 1923 contained many papers dealing with the electrical characteristics and the economical importance of these motors.

The accompanying illustration shows a complete series of compensated asynchronous motors (type Heyland). These motors are designed and built by the Deutsche Werke A.G., in Kiel, Germany. With an output of from 2 hp. to 40 hp., they are rated at 1,500 and 1,000 r.p.m. at 50 cycles. The four smaller motors are squirrel-cage motors, the eight bigger ones have a phase-wound motor. Line switch and fuses are attached to these motors.

FR. KADE.

Kiel, Germany.

Transmission Line Calculations

To the Editor of the ELECTRICAL WORLD:

In the article entitled "Calculations for Transmission Lines" in the May 9 issue of the ELECTRICAL WORLD, Fig. 7 (page 966) should read as follows:

Loss Circles

Center of Circles

$$P = -\frac{3r\,E_r^2}{2000n} = \frac{-3\times.477\times10^{-3}\times63,510^2}{2000\times56.63} = -51$$

$$Q = -\frac{3t\,E_r^2}{2000n} = \frac{-3\times-.0336\times63,510^2}{2000\times56.63} = 3590$$

$$\text{Radius} = \frac{E_r}{577.2}\sqrt{\frac{L}{n} + (k^2 + t^2 - 4mn)\frac{3E_r^2}{4n^2}}$$

Note.
E is always voltage to neutral
+Q is plotted in the direction of lagging power factor
Radius is plotted to the same scale as power in k.w.

No.	Loss in Watts $\frac{L}{n}$	$\frac{L}{n}$	$(k^2 + t^2 - 4mn)\frac{3E_r^2}{4n^2}$	Radius
1	100×10^3	1766	-735	3530
2	200×10^3	3530	"	5820
3	400×10^3	7065	"	8760
4	600×10^3	10,595	"	10,920
5	800×10^3	14,125	"	12,730
6	1000×10^3	17,660	"	14,310
7	1200×10^3	21,190	"	15,750
8	1400×10^3	24,720	"	17,050
9	1600×10^3	28,255	"	18,250
10	1800×10^3	31,785	"	19,390
11	2000×10^3	35,315	"	20,480
			:	

R. G. HORNBERGER,
Assistant Engineer United States Bureau of Reclamation.

Denver, Col.

Central Station and Industrial Practice

Removing Scale from Condenser Tubes

BY R. H. FORNEY
Superintendent of Power Plants, Dallas Power & Light Company

CIRCULATING water for the Dallas Power & Light Company is taken entirely from a spray pond, the makeup for which is obtained from artesian wells containing considerable sodium carbonate and sulphate. As a result the concentration of the water in the pond is very high and continued use of the water in the condensers over a period of three years has caused scale to form in the tubes as thick as $\frac{1}{16}$ in. to $\frac{1}{8}$ in.

Removal of the scale has been satisfactorily accomplished with muriatic acid in the following manner: To circulate the acid solution through the condenser tubes, a 4-in. pump was connected with the suction to the bottom of one water box and the discharge into the top of the other water box. Vents were provided on both the front and rear water boxes to allow escape of the gases formed by chemical reaction. For heating the water, a $\frac{3}{4}$-in. steam connection was made to the hot well on the steam side of the tubes.

PARTICULARS OF TREATMENT

After these preparations, the steam space was filled with water and heated by means of the $\frac{3}{4}$-in. steam line. Then the water space was half filled with water and the acid-circulating pump started, a 20 per cent acid solution being introduced into the suction of the pump. By this procedure the concentration of the acid into the condenser has never exceeded 10 per cent. After the acid has been introduced and the condenser is completely filled, a sample of the water is taken from the pump every thirty minutes and tested for concentration. By keeping the water hot the action of the acid is greatly increased. When the concentration of the acid falls below 1 per cent, the chemical action is very slow, and for all practical purposes the batch can be dumped out through the main circulating pump. The period of treatment generally covers twelve hours to fifteen hours.

After the acid has been dumped out, the condenser is flushed with circulating water to remove all traces of the acid. Then the condenser is opened and the scale that still remains in loose form in the tubes can be blown out with compressed air.

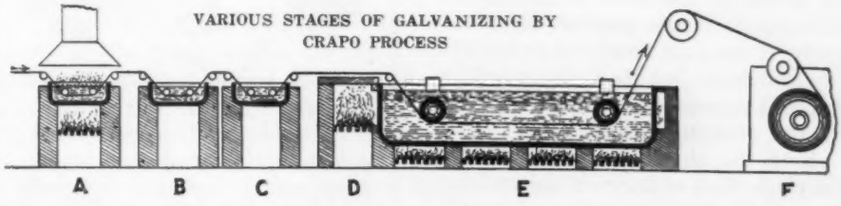
According to the experience of this company, the process can be repeated as many times as necessary to remove the scale completely, the number of times being dependent upon the amount of scale formation to start with. At Dallas it took three treatments to remove scale measuring $\frac{1}{16}$ in. to $\frac{1}{8}$ in. in thickness.

After the scale is removed, as previously explained, rubber plugs are employed for further cleaning. By cleaning the condenser tubes once a week with these plugs, it has been found possible to prevent much formation of scale. Two years have passed since the condensers were cleaned with acid and very little scale has formed since that time.

New Process of Galvanizing

Method Produces Non-Peeling Zinc Coating—Process Described in Detail—Developed by Indiana Steel & Wire Company

ZINC coatings for the protection of iron and steel from corrosion, especially when exposed to weather, are very old in the art and were first applied more than half a century ago. The oldest type of process and the one most generally used today for galvanizing iron wire is the so-called hot-dip process. In this process the iron is prepared for the dip by making its surface chemically clean and then passing it through a solution of fluxing material. Next it passes into the bath of molten zinc for a brief immersion. In the case of wire the process is continuous and a number of wires are dipped at the same time.



VARIOUS STAGES OF GALVANIZING BY CRAPO PROCESS

Except for comparatively minor differences in technique, the hot-dip process has been used in substantially the same way by nearly all manufacturers of galvanized iron wire for many years. In all this period there had been little improvement of major importance, although many manufacturers recognized the great desirability of overcoming the inherent defects in certain grades of galvanized iron, more especially those which approach pure iron. The principal defect was a serious one and did much to shorten the life of the wire and retard its use. As is well known, this defect lay in the tendency of the zinc coating to crack and peel if the wire were bent or twisted rather abruptly, as when wrapped around its own diameter.

Microscopic study of the cross-section of zinc coatings has developed the fact that the structure is divisible into three layers. At bottom or next to the iron there is a layer which consists of a solid solution of zinc and iron that is very high in iron. Directly over this is a layer comprised of zinc-iron alloys and probably a solid solution that is relatively high in zinc. The third or outer layer is substantially pure zinc, although in the case of single-galvanized or tight-wiped wire the quantity of pure zinc is likely to be very restricted.

Naturally the primary object is to put on a coating which will contain the largest practicable percentage of pure zinc and will adhere firmly to the iron. Both of these objectives have been obtained in the new process, which is the invention of Frederick M. Crapo, research engineer of the Indiana Steel & Wire Company, Muncie, Ind. Recent investigations have shown that the

primary cause of failure in zinc coatings when subjected to bending or torsion strains is the absence of a perfect mechanical bond between the iron base and the zinc coating. In this process the uncoated wire is given a preliminary treatment in a bath of molten salts before it passes into the zinc bath. These salts contain carburizing material and produce a very advantageous action on the surface of the wire, cleaning it very effectively indeed as well as leaving it in different chemical condition. The chief features of the process are shown in the accompanying figure.

The wire is drawn to finished size in the usual way and then it enters the bath *A*, where it is immersed for a few moments in the molten salts. Next it passes, in continuous process, through the washing bath *B*, where any adhering salts are removed. Then follows the bath *C*, where the wire is coated with a liquid flux, such as dilute hydrochloric acid. Thence the wire passes over the hot plate *D*, where it is dried, and into the molten zinc bath *E* to receive its protective coating. The wire cools as it passes through the air to the winding reel *F*, where it is coiled in a bundle ready for wrapping and shipping.

The essential difference between this process and the old type of process is the introduction of the new bath of molten salts, shown at *A* in the illustration. As a matter of fact the dip in the molten salts can be given to the wire at practically any stage in the process of manufacture, ranging from the rod to the finished wire, but it is convenient to apply it as shown in the illustration on the preceding page.

Both the physical and the electrical properties of the new galvanizing are of the highest order of merit. Not only can an iron wire galvanized by this process be wrapped around its own diameter without cracking and peeling, but the coating cannot be taken off by any mechanical means except by filing or cutting it away.

Prolonging the Life of Transformer Coils

BY EDMUND J. HENKE
President American Fusion Corporation

OUR REASONS for using electric heat are clear and simple—electric heat gives good results, and it is results we are after. In order to prolong the life of the transformer coils used in our electric welding machines, the coils are impregnated with a clear sterling varnish, and then baked. For best results, it is necessary that the baking be done at the correct temperature and for the correct length of time. If the temperature is too high, "surface hardening" of the varnish will result; if it is too low, the varnish will be "wet." We have found that we get best results by baking our coils about six hours at 270 deg. F.

To secure the proper heating conditions with very little attention a Westinghouse type K oven is used. At the end of the baking period the power is automatically turned off. We remove the first lot, put in the second, and are ready for another bake. We can depend on getting the same good results day after day. Production is never hampered by a shortage of fuel.

Recent Developments of Foreign Breakers

BY C. W. DENNY
London, England

IT HAS been known for many years that increasing the number of breaks in series per phase on a given breaker materially increases its rupturing capacity, because it increases the speed of break and segregates the arc, facilitating its rupture. Segregating the arc enables the arc energy to be dealt with in a number of small sections, which is infinitely preferable to it being concentrated at a point in one large arc, and further by a strong disposition of contacts a strong blow-out action can be obtained.

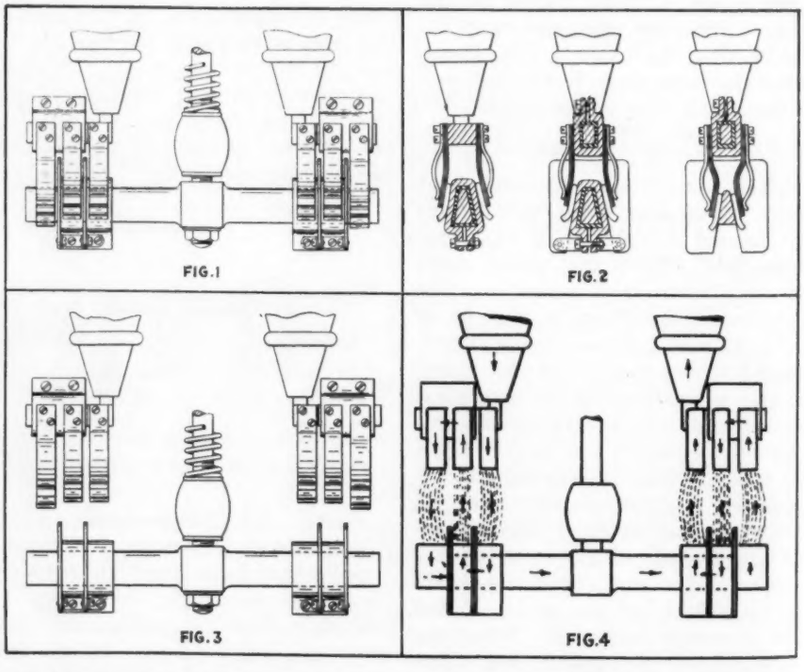
This useful property for increasing rupturing capacity has not been generally utilized, although recently an oil-immersed breaker was manufactured on the Continent having ten breaks in series per phase with highly successful results and several four-break breakers are doing good service in England today.

This apparent lack of enterprise is due to the great mechanical difficulties met with in the design of oil-immersed circuit breakers having more than two breaks per phase.

It is absolutely essential for a breaker to be both robust and rigid mechanically, as any tendency to whip in the moving system cannot be tolerated. Figs. 1, 2 and 3 illustrate an oil-immersed circuit breaker which has been designed to eliminate the mechanical handicaps and to utilize the electrical advantages.

The leading-in and leading-out stems each carry a short horizontal partly insulated copper bar, to which are attached the main stationary contacts; the latter comprise three or more finger type contacts according to the current the breaker has to carry. Two of these contacts are mounted directly onto the insulated copper sleeve, while the third finger or brush is mounted directly onto the base of the terminal.

The moving contacts are designed in a somewhat similar manner; the



FIGS. 1 TO 4—CIRCUIT BREAKER DESIGNED TO ELIMINATE MECHANICAL HANDICAPS

moving blade carries an insulated metallic sleeve at each end so arranged in position as to engage, when the breaker is in the closed position, with two of the stationary finger contacts. The third finger makes direct contact with the main moving blade.

In Fig. 2 a section is given through each of the contacts showing clearly the simple method of support.

By this construction the current is broken simultaneously at six places in each phase, three breaks being provided at each pole. Fig. 4 illustrates diagrammatically the direction and arrangement of the current as it passes through the breaker at the instant of separation of contacts. The arrangement of stationary contacts is such that while the breaker is closed the contact pressure increases with the magnitude of the current flowing, which is of great importance. When the circuit breaker contacts begin to separate, however, the direction of flow of current is such as to produce a strong magnetic blow-out action, which definitely keeps the arcs separated, accounting for the outward bulge shown in the diagram. This bulge lengthens the arcs, increasing their resistance and facilitating rupture. The electrical advantages of a multiple series break have been utilized to the very fullest without sacrificing any of the mechanical considerations.

The same fundamental principle may be incorporated in the design of air-circuit breakers and contactors with very gratifying results, and it is felt that this particular development will undoubtedly prove to be a valuable asset.

Overcoming Cable-Reel Problems

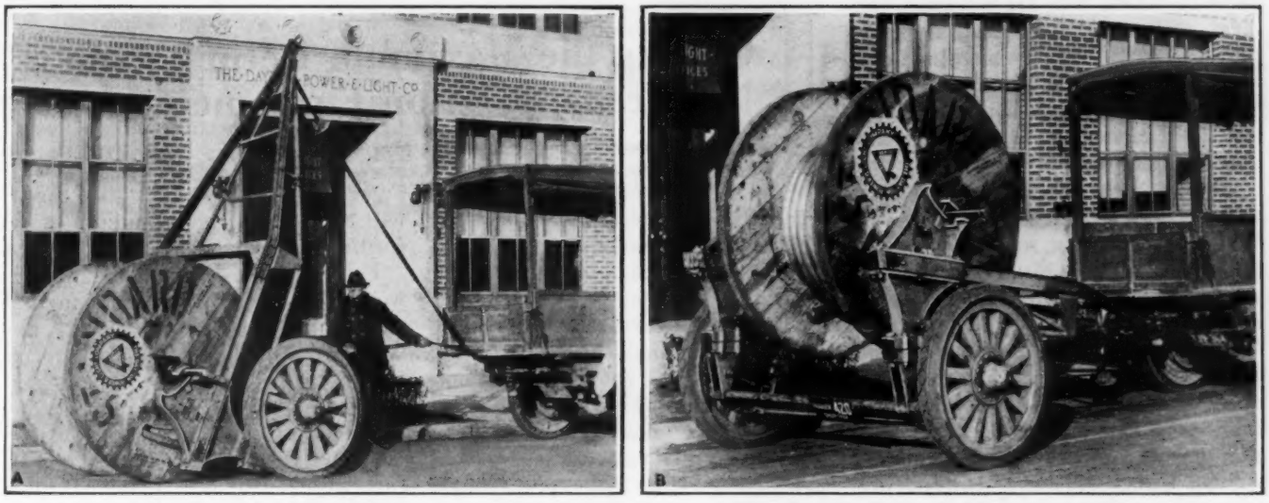
TRANSPORTING cable reels has been greatly facilitated on the Dayton Power & Light Company's system by the use of two-wheel cable-reel trailers. Before the trailers were used, considerable labor, time and trouble were required to load and unload cable reels, valuable space was occupied on the trucks which transported them, time was consumed in jacking up the reels for "paying out" cable and the cable was more likely to become injured in rolling than now.

One of the trailers is shown in position for loading or unloading and transporting or "paying out." To load a reel, the pins are removed from the front hooks on the reel saddles, a rope is tied to the trailer tongue, the trailer body placed in the position (A) to lift reel, the wheels blocked, and the rope fastened to the rear of the truck. By slowly moving the truck forward, the trailer and reel can be brought into a balanced position (B) and fastened to the pintle hook on the rear of the truck. During transportation or "paying out," the pins are kept inserted in the reel saddle hooks.

Unloading involves practically the reverse operations. The trailer wheels are blocked, a rope is attached to the trailer tongue and truck, the pintle hook removed, the tongue raised to disturb balance and the trailer gradually allowed to swing into unloading position by "slacking off" the rope, backing the truck, or both. Removal of the pins in the front hooks of the reel saddle and maneuvering of the trailer will then disengage the reel spindle. By allowing the loaded trailer to rest on the foot attached to the tongue, the cable can be very readily "payed out."

When there is not continuous use for the trailer as a carrier of reels, it can be converted to a pole carrier by removing the four bolts that hold the reel saddles and replacing them with a special bolster. Equipped in this way the trailer will accommodate any length of pole. By resting one end of first pole on the trailer and securing the other end to the truck, the remaining poles may be balanced on the trailer and bound securely to the first pole, which serves as a "reach."

The trailers were designed by American Telephone & Telegraph Company engineers and obtained from the Highway Trailer Company.



CABLE-REEL TRAILER IN POSITION FOR LOADING OR UNLOADING—(A) FOR TRANSPORTATION; (B) FOR PAYING OUT

Hold-Off Tags for Feeders and Cables

BY G. H. MCKELWAY
Westfield, N. J.

TO AVOID accidents due to men working on live lines or having a line which has been killed and upon which they are working made alive without notice to them, some means must be provided for notifying every one concerned that a certain line is to be killed and, after that has been done, to make it impossible for any one to make it alive again until the work upon it has been completed and all hands have been advised that it will be made alive.

In order that all concerned shall

Hold-Off Tag

.....Company
.....Station
Mr. .....
Is working on this circuit.....
Tag ordered on at....M.....19..
Tag ordered off at....M.....19....
Tag put on by .....
Taken off by .....

be informed of the condition of any cable on which men are working, one large company furnishes its employees with strong manila tags, similar to shipping tags, which are to be attached to the handles of any switches connected to the cable in question.

These tags are colored red or blue and are lettered as shown herewith. When there is any work to be done upon one of the circuits the man who is to do the work or the foreman in charge of the gang that is to do it notifies the chief operator of the system. The chief operator calls up all of the stations into which this cable may run and notifies the station foremen to tag the cable at the switch, using whichever colored tag is suitable. When the cable is to be killed and left in that condition as long as the men are working upon it, a red tag is attached to each of the switches connected to it. If the cable has been taken out of service for testing or for some other work which will require that the cable be made alive from time to time, a blue tag is used.

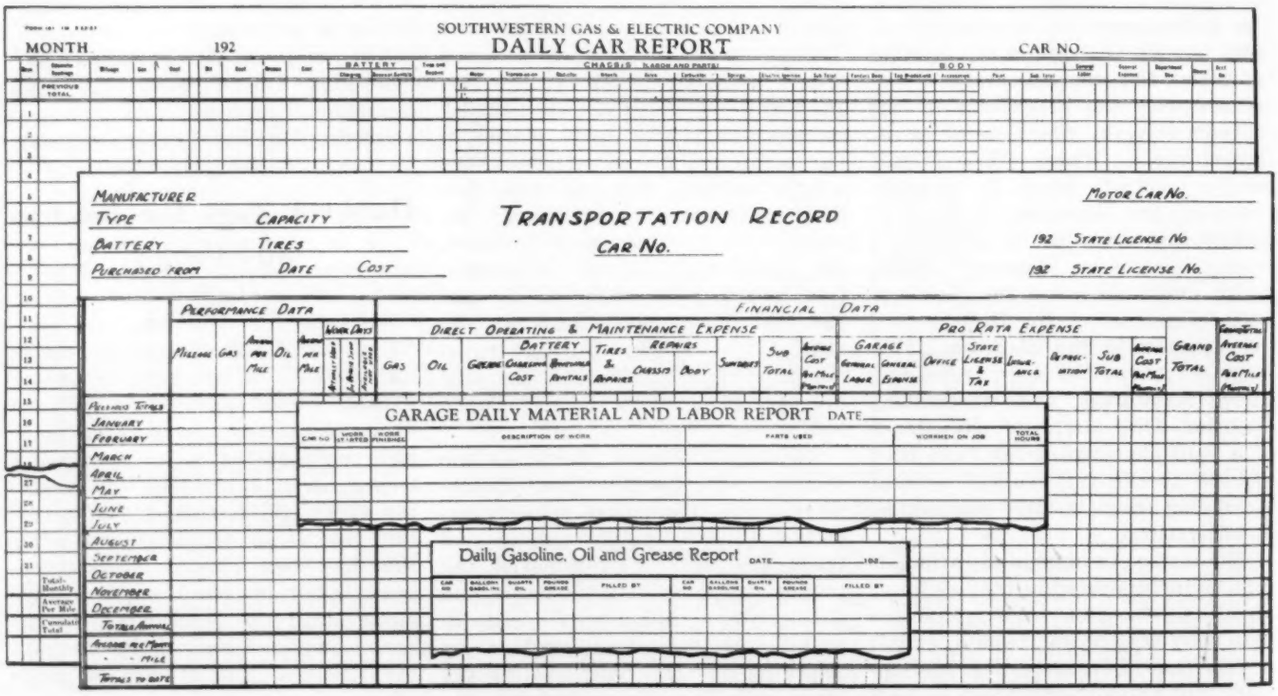
If more than one man or more than one gang is to work upon the line, each unit must be protected by a separate tag and the line cannot be turned over as ready for service until all of the tags have been ordered off by the same men who ordered them put on. On some occasions there has been delay owing to the fact that the man who had the tag on in his name is temporarily away at the time that the work is finished. But in such a case, the fact that all hands present know that the work has been finished is not considered as authorizing the removal of the tags; this work can only be done upon the order of the man who has had them put on. A little time may be lost by this rule, but only upon rare occasions, and it is thought that under no other arrangement could the safety of the men be absolutely assured.

Getting the Maximum Return from Transportation Equipment

BY J. H. MACBETH
Superintendent of Transportation, Southwestern Gas & Electric Company, Shreveport, La.

WHEN a company owns equipment the fixed charges or operating expenses of which constitute a sizable portion of any department's expenditures, it usually behooves that company to keep records that will enable the most economical use of that equipment. In this category most certainly fall trucks and other vehicles used in construction, service, meter and trouble work. If careful watch is not kept of the way in which given types of vehicles stand up in different services and if unit operating expenses are not compared, it is very easy for the expenses of the transportation department to exceed the practically obtainable figure by an amount that will be several times the cost of recording and analyzing the expenses.

For these reasons, the Southwestern Gas & Electric Company has adopted a "driver's car report" and "garage attendant's report" forms for recording material and labor expenditures on each car and also the gasoline, oil and grease furnished each car. These reports are the basis for the "daily car report." Each month the daily car reports are summarized and the recapitulation is recorded on the monthly transportation record so that at the end of the year the average performance and operating and maintenance expenses can be compared for different makes of cars and different services.



SOME RECORDS THAT ENABLE ANALYZATION AND CALCULATION OF TRANSPORTATION EXPENSES

Although the driver's car report may seem long, it has required only a slight amount of explanation to get full co-operation from the drivers. It is pointed out that the data are not just for the accounting department to play with, but that the odometer reading justifies the amount of gasoline and lubricants used, the notations regarding the changing of tires justifies the call for repairs or new tires, the notations regarding the jobs and hours on which the car was used constitute the justification for the driver's salary and the report on accidents is a protection to driver's and company's interests and assures attention to the car by the garage force which may forestall future accidents due to weakened conditions.

To facilitate the recording of the trouble with the cars, avoid general criticisms, assure that troubles will be promptly attended to and furnish an instruction sheet for the repair force, the most frequent causes of troubles with automobiles are listed on the back of the card under general classifications so the driver can easily check the parts that need attention. These notations constitute the repair department's work orders for giving attention to these troubles. Space is provided after each item for the mechanic's initials to enable checking the responsibility for attending to these troubles.

By comparison of the itemized performances and operating expenses of the various trucks in various services, it is possible for the record clerk to admonish any driver for failure to report properly or for his inability to obtain results comparable with those obtained in similar service. Checking back on the drivers occasionally has been more effective than anything else in making them careful with their reports and with the handling of their vehicles. Furthermore, the notations on the back of the driver's car report afford a means of checking up the repair department when troubles are not attended to promptly.

As a further incentive to careful use of its equipment, this company has offered a prize of $25 to be awarded each month to the driver whose record is the best for the month. Many points are considered, such as observance of company rules; traffic violations; accidents; and the mechanical record of operation. However, the age of the car and the character of the work are also considered, so that every driver who shows marked improvement has an equal chance. The lowered cost of operation which followed the adoption of the bonus was very gratifying and more than justified the extra trouble and expense.

All cars of a light and well-known make are turned in periodically for new equipment. This policy has worked out to this company's satisfaction and reduced operating costs materially with a corresponding increase in service efficiency. The cars used by the officials and field men are also turned in each year when the mileage and character of the work justifies, thus always leaving equipment that is ready for every emergency. The heavier and more expensive equipment is retained for longer periods based on the expense of upkeep and character of work.

For comparison the following items of fleet costs may be of interest: For the year ended July 1, 1924, the entire fleet of forty-seven cars operating for the full period of twelve months and covering different makes composed of Fords, Dodges, Buicks, Chevrolets, Stars, G.M.C., Fords and White trucks, the average cost per mile was $0.048. This covers straight operating costs, including gas, oil, repair parts and repairs, tires and repairs and garage labor, the latter covering the mechanics and washmen. These items constitute, this company believes, the best basis for comparison. Different methods of depreciation, variance in license fees, insurance, etc., would insert many variables if included. Drivers' wages are not included, as most of this company's drivers are mechanics who drive the car only as a means to perform their work and are charged to the different departments. Monthly records are of value to this company alone, as they cover the methods peculiar to this particular system.

It might be mentioned that since the adoption of the prize system in September this company has operated a fleet of fifty-one cars at an average cost per mile of $0.036. This covers a total of about 50,000 miles per month.

Car No._____ DRIVER'S CAR REPORT Date_____ 192__

Time of Leaving_____ Return_____

Odometer Readings Start_____ Finish_____

Tires Changed_____ R. F._____ R. R._____ L. F._____ L. R._____ Tag No._____

Car Used On_____ Hrs._____ Hrs.

_____ Hrs._____ Hrs._____ Hrs.

_____ Hrs._____ Hrs._____ Hrs.

Report on Accident_____

Department_____ Driver_____

If Car Needs Attention Report on Back of This Card

DRIVER'S CAR REPORT (SEE ACCOMPANYING TABLE)

INSTRUCTION RECORD FOR REPAIR FORCE

This list is printed on the back of the "Driver's Car Report." Space is left on each side of each item for a check mark and for the mechanic's initials.

Motor
No power
Knock
Spark plugs foul
Missing
Heats

Ignition
Distributor
Battery
Wiring
Generator
Magneto
Spark plug
Control rods
Gas control
Accelerator

Gas System
Gas lever
Control rods
Float
Gas line
Tank leak
Manifold

Cooling System
Radiator leaks
Pump
Top hose
Bottom hose
Fan belt pulley

Lubrication
Crankcase
Oil lines
Springs
Wheels
Clutch
Transmission

Steering Gear
Loose
Adjustment
Wheels
Wabbles

Brakes
Hand brake
Foot brake
Re-line
Adjustment

Springs
Front
Rear
Leaves
Shackles

Lights
Head
Tail
Gas lights
Presto tank

Chassis
Radius rods
Tie rod
Clutch
Exhaust manifold
Differential
Muffler

Transmission
Wheels
Axles
Rear end
Drive shaft

Body
Top leaks
Windshield
Curtains
Seat
Floor board
Running board
Tire rack
Side board
Tail board
Fenders
Gages
Odometer
Tool boxes
Winch
Trailer

Commercial Activities and Public Relations

Spokane Range Sale Adds $30,000 Gross Revenue

BY W. T. RYAN
Washington Water Power Company,
Spokane, Wash.

SERVING a total population of 180,000, the Washington Water Power Company has approximately 35,000 residential customers, of whom 26,500 are located in Spokane. At the end of 1922 the company had on its lines about 4,000 electric ranges and water heaters, divided on about a 60-40 basis between Spokane and outlying territory, indicating a saturation of 14 per cent. Four special campaigns on ranges and water heaters were sold in 1923 and 1924, when about 1,500 more ranges and water heaters were added. By Jan. 1, 1925, the company had approximately 6,000 range users, with a saturation of 16.6 per cent for the whole system. Spokane showed a saturation of nearly 13 per cent and the outlying towns 28 per cent.

In a rapidly growing territory, where there is a fair volume of new construction of residences and apartments, range campaigns are a simple matter, but where the population is permanent and its growth comparatively slow, a great amount of study based upon an intimate knowledge of local business conditions and prospects is necessary. This was particularly true of the company's range sale this year. The territory contains two important wheat-producing areas; before the campaign the prospects for wheat, both as to crop and prices, were regarded as uncertain. This feeling was reflected in a marked sluggishness in range sales during the first few weeks of the campaign. Then a heavy general rain occurred and at the same time a trend toward higher prices for September wheat became manifest, and the result was a sharp improvement in range sales in all the towns in these areas.

In planning the sale quotas had to be set for the whole system in order to insure delivery of ranges on purchase orders; the amount and cost of advertising had to be estimated, and similar important details had to be planned in full. The Hotpoint Super Automatic Range of the Edison Electric Appliance Company was selected as the special feature for the campaign, and a price was determined upon covering range, water heater, wiring and installation. As a special inducement a cooker unit was offered with each range. The campaign was begun April 6 and ended May 16, a period of six weeks. A quota of 200 ranges was set for Spokane and 130 for the country towns.

The power company maintains a stable and permanent sales organization in which it considers itself fortunate. In the country towns, sales are handled by twenty-four district and local agents, and in Spokane by the electric shop at the general offices and by eight regular city salesmen who have fixed territories in the city. Of these eight salesmen, four had taken part in four previous range campaigns and only one had had no previous campaign experience.

Advertising included newspapers, broadsides, and in Spokane two illuminated billboards located on principal car lines. Broadsides were mailed to all residential customers during the first week. In the Spokane daily papers 1,805 in. of space, in twenty-five insertions, was used. The results of the campaign are shown in the accompanying tabulation.

The sales were made on the basis of $9.75 down, with time payments as low as $10 per month. The city salesmen were allowed the regular commission of 10 per cent, and in addition special prizes were awarded each week to the three salesmen selling the greatest number of ranges. These prizes were based upon $1 per range for all the ranges sold that week, and the pot was split in the ratio of 3:2:1. For the eight city salesmen a campaign quota of twenty-five ranges was set, and a $25 prize was awarded to each man who made his quota. Five such prizes were awarded. Among the country towns, twelve out of the twenty-four district and local agents exceeded their quotas.

Thus by six weeks' intensive effort, $80,000 worth of merchandise was sold and the prospective revenue of the Washington Water Power Company was increased by $30,000 per annum. The number of range users on the system was increased to 18 per cent, and instead of feeling that this is the limit, the officials of the company believe that the chances for increasing sales of ranges have been increased.

RESULTS OF WASHINGTON WATER POWER COMPANY'S ELECTRIC RANGE SALE

	Spokane	Outside Towns	Total
Population	118,000	62,000	180,000
Residential consumers	26,363	8,550	34,913
Ranges sold: Super automatic	158	69	227
Other hotpoint	67	40	107
Other makes	19	22	41
Total sold	244	131	375
Gross sales value	.....	.....	$80,000
Average price for installation, range and water heater	.....	.....	$215
Annual revenue at $80 per year	.....	.....	$30,000
Grand total in service	3,755	2,576	6,331
Percentage of residential customers	14.2	30.2	18.1

Brickyard Uses 1,000 Hp. in Motors

BY G. R. MITTEN
Power Sales Department,
Public Service Company of Northern Illinois

WITH a motor installation of 1,000 hp., the Brisch Brick Company, Stickney, Ill., is building a plant with a capacity of 8,000,000 common brick per month. Among the motor-driven machines will be an electric drag line for handling clay from the pits.

The maximum demand of the new installation is estimated at 450 kw., with a monthly load factor of 30 per cent. The energy consumption has been placed at 13 kw.-hr. per thousand brick manufactured. A power contract has been signed with the Public Service Company of Northern Illinois to supply the entire load and a 33,000-volt line will be built to carry service to the customer's property, where transformers will step the voltage down to 440 volts for plant operation. Service will be metered at 440 volts, three phase, sixty cycles.

Modern brick plants are turning more generally to central-station service for their power supply, and the older plants are being remodeled as rapidly as possible with the idea of utilizing the economical and reliable service supplied by public service companies and relieving the brick plants from the maintenance expense and inefficiency that universally prevail in the power plants of that industry.

Refrigeration Exhibit Stimulates Sales

MORE than fifty immediate sales and hundreds of "prospects" for electric refrigeration were obtained at Boston recently by seven representative houses sharing a pioneer co-operative exhibit under the general direction of C. E. Greenwood, superintendent of the appliance department, Edison Electric Illuminating Company. The idea of a co-operative exhibit specializing in this field was first presented to the Boston trade at a luncheon planned to establish better acquaintance among manufacturers' representatives in the refrigerating line and at which the Edison company was host. Mr. Greenwood originated the plan for the exhibit and the company provided free space, decorations, lighting, power and advertising at a cost of about $2,500, exclusive of staff labor.

The exhibit occupied an attractive vacant store, 100 ft. x 70 ft. in floor area, with entrances on both Boylston and Newbury Streets, in the heart of the new Back Bay retail district. No display was made by the Edison company, and the exhibitors had wide latitude in handling visitors according to their own ideas. Before the first "get-together" luncheon took place no two dealers were acquainted. All were enthusiastic from the start. The advertising in the Boston dailies was liberal in amount and attracted many hundreds of visitors, although no attempt was made to attract mere numbers in attendance. The location of the display, its dignity of decorations and general tone attracted a large number of motor-car owners.

FIG. 1—THESE WINDOWS ATTRACTED MANY REFRIGERATION "PROSPECTS"

The show was open daily except Sunday from 10 a.m. to 8 p.m. At times some concerns had as many as four men getting leads, and the display was so attractive that the owner of the building became an early purchaser of a refrigerating outfit for his own home. A rest room with electrically cooled drinking water was provided at the rear of the displays. During the show an address on electric refrigeration was broadcasted from the Boston Edison company's radio station ("WEEI") by Miss Majorie Mills of the "better homes bureau" of the Boston *Herald-Traveler*.

Inquiries from Maine and from other distant points were received at the show as a result of the publicity given it. One manufacturer sold eight machines in one day during the week. The exhibitors were the Champion Electric Company, Frigidaire Corporation, Kelvinator, National Automatic Refrigerator Company, S. L. Prentiss Company, Serv-el Coporation, and the Thermo Appliance Company.

Final Report of Lighting Educational Committee

THE Lighting Educational Committee, of which J. E. Davidson, the new president of the N.E.L.A., is chairman, has published a final report of its work in connection with the Better Home Lighting Activity and the Better Home Lighting Contest among the school children of the

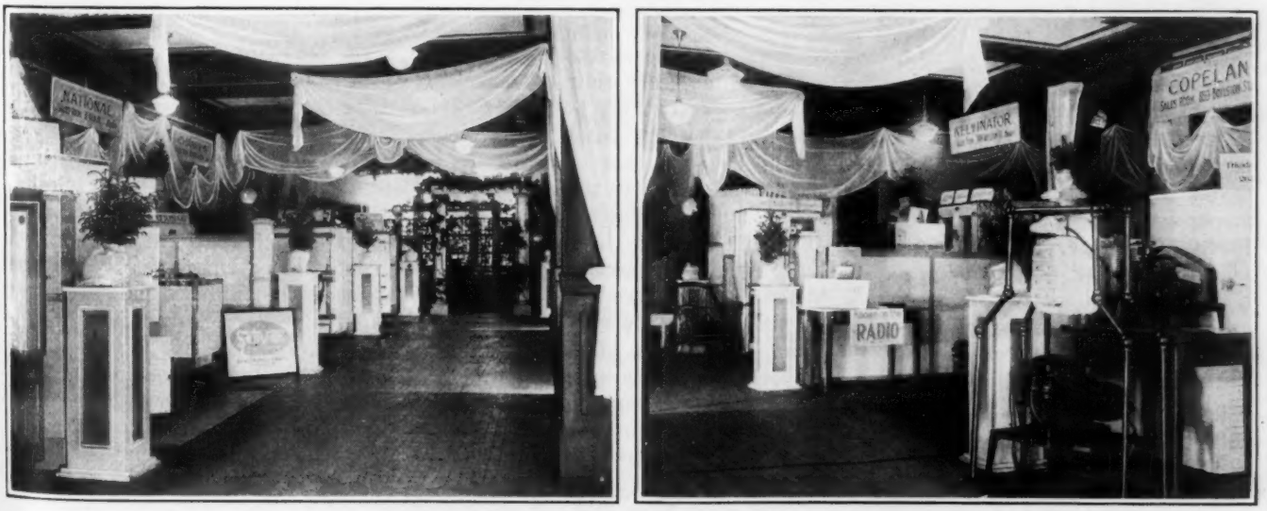


FIG. 2—COMPETING MACHINES WERE DISPLAYED ON EVEN TERMS

United States and Canada, which played a major part in the movement.

The report describes in detail the organization of the committee, the methods it used to attract the attention of the public and the results obtained. It comments particularly on the co-operation generally obtained from the school authorities and the excellent results that followed at comparatively low cost when such co-operation was received.

The report is well illustrated and as long as the supply lasts copies may be obtained from the Lighting Educational Committee, 29 West 39th Street, New York, N. Y.

Customer Owners Should Be Real Partners

Utility Investment Manager Outlines Basis for Selling Stock to Public—Maintaining Stockholders' Faith and Interest a Continuing Obligation

THE IMPORTANCE of the difference between merely selling a stock certificate to an investor and selling a partnership to a customer owner was emphasized by S. J. Ballinger, manager of the investment department of the San Antonio Public Service Company, before the recent annual convention of the Southwestern Public Service Association at Houston, Tex. Money can be obtained much more easily and cheaply by other means than selling securities to customers, so that the advantage of customer ownership campaigns lies in the good public relations fostered and in the interest aroused in the company's welfare through making stockholders feel that they are really partners. Mr. Ballinger outlined his ideas of the fundamentals of selling stock to customers as follows:

"1. The very basis of a successful sale and foundation of pleasant, satisfactory relations, present and future, is deadly accuracy. Those selling must know their stuff. Tell the whole story and tell it truthfully. We don't need high-pressure salesmen in this business, for I had rather trust a loyal, well-informed employee to tell his story simply and clearly than to put my trust of building up customer ownership in the best salesman obtainable.

"2. Sell them a part of the company and not a certificate. It is much easier to sell a certificate, but you are lying down on the job if you stop there. Convince your prospect that you are making him part owner of a company the activities of which are closely allied with general public interest and welfare.

"3. Tell them something of the great transposition of public utility capital from the large investor to investors of moderate means. Let them know that our business is an investment, not a speculation, and that regulation and protection against unnecessary competition, combined with new ideas of the characteristics of our business and new conceptions of our obligations, have diverted the course of our financial channels.

"4. Personally, I attach much importance to the personal contact surrounding the initial sale and future relations. It seems to me that the sale of our stock should be direct from company to consumer or through an agency expressly created for that purpose and controlled by the company. I feel that employees who have had the fundamentals of our business drilled into their minds are the ones most likely to sell the company along with a stock certificate. Stock salesmen, on the other hand, are often trained to concentrate entirely upon the sale of a security. The question is, Are we out to make customer owners or merely to get money? Upon the way the story is carried to the future stockholders in initial negotiations depends the relationship that may exist in the future. Will it be that of an investor or that of an owner?

"5. There should be a distinct understanding with your customer about the resale of his stock. It is my opinion, of course, that we should do everything possible to help the stockholder resell his stock. When he buys stock, however, he should be made to understand that he is buying a piece of property; that this property is devoted to useful community purposes; that it is real and that there is no reason why it should not always have a good market value. In other words, it is important that we make no promises and no commitments in the interest of future relations. Teach them to buy property from you as they would buy it from a real estate man.

"After we have sold our stock and sold it properly we have planned the foundation for continuing relations with customer owners on a satisfactory basis. But we cannot stop there, and these few suggestions will give you my idea of continuing the good work:

"1. Write them a letter every three months advising that their dividends have been authorized. Most companies do this. However, don't stop at that. Make your letter friendly and human and tell them some of the important things that have transpired in your business since their last dividend was authorized. Our business is chock full of human interest, of romance and of facts and figures that will literally thrill and startle the tyro owner.

"2. Invite them to your annual stockholders' meetings. Most companies do this, but again it might be wise at times if something unusually important comes up affecting their interest and your interest to call them in for another meeting. Talk it over with them; get their view. No one is too wise or too brilliant to absorb a good idea or a constructive thought from his most humble acquaintances. More meetings, more fraternizing mean better acquaintance and better understanding.

"3. Send them bulletins frequently, or if you have a company magazine, send it to them. Here again you can go a little farther by putting some personal news about your stockholders into this magazine and telling the story of the public utility business again and again. New people are coming up and old ones are passing away. We are too prone to feel, to think and to say that this story or that information is stale, elementary or simple. Stuff that is old and worn to us is like a bright, shining toy to the new stockholder.

"4. No manual or code on this subject would be complete without reiterating that worn-out suggestion, 'Tell it with printers' ink.' By all means use your letters, your bulletins, your magazines and take advantage of your personal contact, but never lose sight of the fact that the greatest medium for carrying messages to the public is the daily newspaper of today. Advertise and keep on advertising—not extravagantly but intelligently. More printers' ink properly applied means better citizens and better stockholders. Columns of newspaper space may be transformed into columns of stockholders drawing dividend checks."

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Additional Power for the Tri-Cities.—A station with an initial installation of one 25,000-kva. turbo-generator unit, the turbine being bled at four points for air preheating and feed-water heating, is to be put into operation early this summer near Davenport, Iowa, to serve the industrial district comprising the cities of Davenport, Rock Island and Moline. The present article, which is illustrated, gives numerous details regarding the new plant as well as a tabulated summary of principal equipment.—*Power Plant Engineering*, May 15, 1925.

Automatic Spillway Gates of Black Canyon Dam.—JULIAN HINDS.—The purpose of this dam across the Payette River in Idaho is to deliver water by pumping to an irrigation district, develop electric power and eventually deliver water by gravity to another main irrigation canal. The height to which water may be raised is limited by the tracks of the Idaho Northern Railway, but in order to meet power and irrigation requirements it is essential that the normal water surface above the dam be held at the highest permissible level at all times. Flood waters must therefore be passed with practically no increase in water level. This is accomplished by the use of automatic gates which involve certain new features. The description is accompanied by detail drawings and views of the installation.—*Engineering News-Record*, June 25, 1925.

Hydro-Electric System of the Pacific Gas and Electric Company.—J. P. JOLLYMAN.—Treated rather briefly, but definitely, with the inclusion of considerable data, the geography and topography, climate and water supply, water conduits and transmission system, through which points as much as 812 miles apart are operated in parallel, are successively taken up. Finally there is a table of the company's twenty-eight plants, with 398,975 kva. installed, operated at static heads up to 1,865 ft. and including single installations up to 81,000 kva. For each plant there are given the head, length of penstock, number of units, type of waterwheel, installed kva. and transmission voltage.—*Electric Journal*, June, 1925.

Generation, Control, Switching and Protection

Dipped-Insulated Joints.—A. EIMERS.—Permanently reliable joints in light and power installations in wet surroundings, such as chemical industries, stables, etc., are difficult to make. The article describes a new and simple method of accomplishing this, by clamping the bare ends of the wires together in a small screw clamp and by subsequently dipping this joint in a small cup, filled with melted insulating compound, the cup with the hardened compound remaining part of the joint. Experiences with this patented system of making joints were excellent and established absolute and permanent tightness. — *Elektrotechnische Zeitschrift*, May 14, 1925.

Short-Circuit Investigations on Generators.—H. RIKLI.—Transient current conditions on synchronous machines during short circuits are well known and have been the subject of many investigations and articles. Very little has, however, been published on the mechanical breaking action of a short circuit upon the revolving masses of generators and driving machines. The author has undertaken such tests on a 3,000-r.p.m., 2,500-kva., two-polar turbo-generator and gives in this paper the theoretical and practical results of his investigations. Special mechanical apparatus had to be developed and attached to the generator to give, in connection with an oscillograph, always the exactly desired instant of short circuit. The breaking energy as a function of time is subjected to great variations. For a three-phase short circuit these variations are proportional to the frequency of the generator, for a single-phase short circuit to double the frequency. The maximum breaking energy was obtained for a single-phase short circuit, reaching momentarily about 25,000 kw., or ten times the rating of the machine. A large number of reproduced oscillographs show the various phases of single and polyphase short circuits as recorded during the author's tests.—*Bulletin de l'Association Suisse des Electriciens*, May, 1925.

Transmission, Substations and Distribution

Full-Load Tap Changing on Transformers.—CH. KRÄMER.—The voltage regulation on transformers under full load is usually accomplished by means of induction voltage regulators. These machines have several disadvantages, such as phase displacement, high cost and a voltage limited to a maximum of 15 kv. The article describes a voltage regulation by steps directly on a transformer winding with taps. All the taps are brought out of the transformer tank and are connected to vertical rows of contacts, over which slide a multiple brush. The entire contacting arrangement operates in air. To avoid arcing when going from contact to contact, a set of auxiliary brushes diverts the arcing current to fixed resistances. The tap changer may be operated either by hand or remotely by a small motor. All taps on the transformer are arranged electrically in the neutral point of the Y-connected three-phase machine. The apparatus is suited for up to 35,000 volts and is claimed to have given good service.—*Elektrotechnische Zeitschrift*, May 21, 1925, and *A E.G. Progress*, May, 1925.

The 4,000-Volt Distribution System of the Duquesne Light Company.—SAMUEL ROSENBACH.—The distribution circuits of the company named, serving an important industrial region and extending over an area of about 1,000 square miles having a population of approximately 1,700,000, are being changed over for 4,000-volt, three-phase, four-wire operation. Details are given regarding the methods adopted and forms of construction used.—*Electric Journal*, June, 1925.

Units, Measurements and Instruments

Dielectric-Strength-Thickness Relation in Fibrous Insulation.—F. M. CLARK and V. M. MONTSINGER.—Experimental data obtained by the writers have led to the conclusion that the relation between dielectric strength and thickness may be expressed by a logarithmic formula $K_v = AT^n$, where K_v is the breakdown voltage in kilovolts, A the strength per unit thickness, T the thickness and n a numerical value generally less than unity. A research was conducted to determine the value of n: First, as a function of the testing methods; second, as a function of the dielectric, and, third, as a function of the insulation history, i.e., the drying procedure used, the subsequent treatment, etc. It was found that, with a given material, n increases as the diameter of the testing electrodes is increased. No essential difference was found between the effect with straight-edged and with rounded electrodes, but the use of a close-fitting "protection" of albarene stone on one electrode changed n for a certain condition from 0.71 to 0.80, and when on both electrodes to 0.86. Roughening the electrode lowered A but did not change n. The maximum value is reached for untreated fibrous materials; the effect of varnish or oil treatment is to lower the relationship to a value approaching $n = 0.75$ for all insulation. Further, this exponent is considerably lowered by immersion in hot oil, prolonged exposures to high temperatures during drying, or the application of long-continued voltage stresses even of relatively low values. The relationships described above are shown by a number of charts.—*General Electric Review*, May, 1925.

Iron Losses at High Frequency.—G. W. O. HOWE.—Under the general caption "Notes on Wireless Matters" the apparent reduction in permeability of iron at very high frequencies, due to the screening of the interior of the laminations by the demagnetizing action of eddy currents, is analyzed mathematically. Taking this distortion of flux into account an equation is deduced for the eddy-current loss. The conclusions are reached that at high frequencies the eddy-current loss is proportional to the thickness, not the square of the thickness, of the laminations; it is proportional to the 1.5th power of the frequency, not to the square; it is inversely proportional to the $\sqrt{\mu\rho}$ and not to ρ, the specific resistance of the iron.—*Electrician (England)*, June 12, 1925.

Illumination

Unusual Phases of Power-House Lighting.—A. F. LOEWE.—Suggestions are given for the suitable lighting of

turbine rooms, boiler rooms, ash-handling pit, outdoor switching equipment and other places about the plant. Emphasis is placed on the fact that in view of the small force responsible for the operation of the modern power plant adequate and well-designed general illumination is essential, gages and instruments must be easy to read, the glare from bare or improperly placed sources must be avoided, and on account of the presence of dust a regular cleaning schedule must be maintained. Several special devices for this type of service are described and illustrated.—*Power Plant Engineering*, May 1, 1925.

Records of Total Solar Radiation Intensity, and Their Relation to Daylight Intensity.—HERBERT H. KIMBALL.—An attempt is made to ascertain with what degree of accuracy records of total radiation of heat energy received on a horizontal surface directly from the sun and diffusely from the sky may be used to determine the intensity of daylight illumination on a horizontal surface. In this study a number of charts and tables are introduced which should also be useful in other connections. These include curves of distribution of solar energy in atmospheres of various degrees of transparency, and with the sun at various zenith distances, computed from Abbot's normal solar energy curve and transmission coefficients for different wave-lengths; a curve of color-temperature of direct sunlight against air mass; observed ratios of direct solar radiation on a horizontal surface to diffuse sky radiation for various solar zenith distances at a number of stations; a table of energy distribution, at fifteen different wave-lengths in the visible spectrum, of sunlight and skylight with the sun at various zenith distances; illumination equivalents of radiation, and graphical records, for several days, of received radiation. Combining the computed and observed data factors are derived which when applied to radiation intensities should give daylight intensities with an accuracy comparable to that of ordinary photometric readings. — *Transactions of the Illuminating Engineering Society*, May, 1925.

Motors and Control

Purchased Power as Applied to Plate-Glass Manufacture.—A. L. HARRINGTON.—A summary of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, April 25, 1925, on page 862.—*Journal of the A. I. E. E.*, May, 1925.

Phase Compensation. — T. ELLIS.—Three methods of phase compensation for use with induction motors are reviewed: (a) Three-phase exciters with series characteristic, employing pure armature excitation and no commutating poles; (b) the same as (a) but in addition some stator excitation and also commutating poles; (c) three-phase exciters with separate excitation and commutating poles. These are compared as to their characteristics, construction, and application.—*Electrician (England)*, May 22, 1925.

Pressure Regulator for Electric Air Compressors.—F. ECKINGER.—Stationary electrically-driven air compressors, as well as those installed on locomotives and motor cars, require an automatic valve that controls the driving motor in such a way as to maintain the air pressure in the reservoir within certain fixed minimum and maximum values. The present article gives an accurate description of such a valve, representing a combination of a spring-controlled pneumatic piston and a likewise pneumatically-operated quick-break switch. The device is manufactured for electrically widely-varying ranges. The pneumatic part is the same for all, but the upper contacting apparatus can be obtained in twenty-four models, suitable for currents between 1 amp. and 300 amp., and voltages from 50 to 3,300. Some of these types, controlling energies between 30 kw. and 150 kw., have magnetic blow-out to reduce arcing.—*Brown, Boveri Mitteilungen*, June, 1925.

Electrophysics, Electrochemistry and Batteries

Electron Emission from Oxide-Coated Filaments.—LEWIS R. KOLLER.—Platinum iridium filaments were coated with oxides of Ba and Sr by repeated dipping in a solution of the nitrates and burning in a CO_2 atmosphere. Under good vacuum conditions the emission corresponds to the equation

$$I = aT^2e - bT$$

where $a = 0.00107$ amp. cm.^{2} and $b = 12{,}000$ deg. for the filament studied. The presence of oxygen in small amounts decreases the emission tenfold to a thousandfold, while argon, hydrogen, CO and CO_2 cause a great increase. These results indicate that the emission is not due to the oxides but to a film of metal. Positive ion bombardment also increases the emission, probably by reducing some of the oxide. Flashing at 1,600 deg. K for one minute to five minutes deactivates the filament, but heating at lower temperatures (900 deg. K) restores the activity. Distribution of initial velocities was found to follow Maxwell's law, but the average energy came nearly 30 per cent higher than that corresponding to the temperature of the filament.—*Physical Review*, May, 1925.

Traction

Parallel Operation of Rectifiers.—E. KERN.—A simple graphical method is shown to determine the conditions at which mercury arc rectifiers will operate in parallel with each other, with a rotary converter or a battery. It is shown how, with properly chosen and inserted inductances, any desired distribution of load among the parallel operating machines can be obtained. If, for example, a rectifier runs in parallel with a rotary, it is most economical to have the latter always fully loaded while the rectifier takes only care of the peaks. This is necessary because the rotary will have its maximum efficiency only near its rated load, while that of the rectifier remains almost constant for a wide range of loads.—*Brown, Boveri Mitteilungen*, June, 1925.

Present Status of Railway Electrification in Austria.—P. DITTES.—Among all the civilized countries of the world, Austria is now leading in electrified railroads as far as the percentage of its existing railways is concerned. In 1928 there will be 1,530 km. of its roads electrically driven, of which 1,100 km. are being operated electrically at present. In this paper of twenty-eight pages, illustrated with thirty-two drawings and photographs, the author gives his annual review of the Austrian electric railway situation, describing the progress made on the latest power houses, rolling stock, and track equipment.—*Elektrotechnik und Maschinenbau*, May 24, 1925.

Heat Applications and Material Handling

Electrically-Driven Car Hoist.—P. HOEPFFNER.—In railway car building plants and in carhouses of railroad terminals, assembly or inspection of a car is much simplified if the car is bodily lifted off the tracks. This short paper describes such a device, used on French roads. The apparatus resembles a rolling crane resting on two wheels on each track. One heavy lifting claw, arranged as a traveling nut on a large vertical spindle, is driven by one three-phase motor on each side, the two motors being synchronized and are operated from one controller. A total lift of 65 in. is possible. Rail grips and brakes are provided to stabilize the car hoist sufficiently.—*Bulletin de la Société Alsacienne*, April, 1925.

Telegraphy, Telephony, Radio and Signals

Trans-Pacific Radio Field Intensity Measurements.—L. W. AUSTIN.—The paper describes measurements on the daylight radio field intensity produced in San Diego, Cal., by the arc stations at Cavite, Philippine Islands, 11,800 km., and Malabar, Java, 14,700 km. distant. These distances are nearly twice as great as any previously studied, except for a few scattered measurements. The average observed intensities were, from Cavite 2.04 μ volts per meter, and from Malabar 4.02 μ volts per meter, while those calculated from the Austin-Cohen formula are respectively 0.69 μ volts per meter and 1.83 μ volts per meter. The ratios of observed to calculated values indicate an increase in the divergence from the formula with increasing distance, but not so great as was indicated by earlier scattered observations.—*Proceedings of the Institute of Radio Engineers.*—April, 1925.

Signal Strength Measurements.—Capt. H. J. ROUND, T. L. ECKERSLEY, K. TREMELLEN and F. C. LUNNON.—In this abstract of an I. E. E. paper results are given of experiments made over great distances during 1922 and 1923 by an expedition sent to Australia. Reference is made to the reception of signals simultaneously from two directions and to beats showing transmission both ways around the earth, to seasonal variations, to the observed minimum values when it is half light and half dark between stations, and to attenuation formulas. A curious fact is that, in general, on the longer wave lengths signals going by the west-to-east path are in excess of what would be expected and those in the opposite direction are less.—*Electrician (England)*, May 8, 1925.

New Books

Personal Leadership in Industry

By D. R. Craig and W. W. Charters. 245 pages. New York: McGraw-Hill Book Company.

This book purposes to make available the experience and thinking of successful executives. It does the job splendidly and is the type of definite self-analytic study with real suggestions that ambitious young men will value. There is very little generality in the work and a large amount of good common sense. The authors advocate checking a list of questions concerning leadership measurement given in the last chapter and then reading those chapters devoted to the qualities in which the reader feels himself inferior. But every word in the book is written in a vigorous, optimistic style that will repay a careful perusal, and the whole treatise can serve as a daily self-improvement course. Executives and workers in the electrical industry can get real profit from this book on personal qualities and habits and their adaption to business organizations.

Concerning the Nature of Things

By Sir William Bragg. 248 pages, illustrated. New York and London: Harper & Brothers.

Faraday, Tyndall, S. P. Thompson, Lodge, Fleming, Dewar and a number of other brilliant scientists have given the "Juvenile Lectures" of the Royal Institution since the establishment of these courses in 1826. But these lecturers did not face the problem solved so ably by Sir William Bragg in his 1925 "Juvenile Lectures," published in this book. He tried to make clear to the layman the structure of the atom and surely succeeded. Many original and ingenious diagrams and splendid analogies from everyday life were used, this book shows, to make one of the most abstruse subjects of science clear to the lay mind. The atom itself, the nature of gases and their behavior and the molecular forms of liquids and crystals are discussed to show the unity of the universe of matter and the real and assumed knowledge now possessed by man of the liliputian world. Any layman interested in science will read the book with understanding and pleasure.

Die Beleuchtung von Eisenbahn-Personenwagen

By Dr. Max Buttner. 207 pages, 120 illustrations. Berlin: Julius Springer.

The author gives in this book a comprehensive story of the development of railroad-car illumination, beginning with candlelight in 1844 and continuing up to the latest word in combined axle-driven dynamo and battery lighting. The long but unsuccessful fight of gas illumination against the gradually improving electric light is well recorded. Today electric car lighting has almost completely superseded gas, and for this reason five-sixths of this book deals with the various systems of electric lighting methods. A full account is given of storage batteries, generators and regulating devices such as are used on railroads in different countries. Included in the book is an account of the illumination of steam locomotives, for which the author cites a number of American systems. Cost data for the installation and maintenance of various car-lighting systems add interest. A. P.

Fundamentals of Business Organization

By Webster Robinson. 229 pages, illustrated. New York: McGraw-Hill Book Company, Inc.

According to the author there are eight fundamentals in business organization—definite and stable policies, functionalization, the right man in the right place, direction, supervision, control, delegation, and co-ordination of authority, and responsibility and incentive. These topics are discussed in separate chapters with sufficient detail and specific examples to give a logical and clear picture of modern business organizations. Written as a textbook and constituting a departure from the beaten path, sound treatment and thorough analysis made, make this a real volume for all business men. It is a book of business principles and organization philosophy which, without going into dry details as to mechanism and forms, yet gives the essential analysis necessary to run a modern business.

Alternating Currents and Transients

By F. M. Colebrook. 195 pages, illustrated. New York: McGraw-Hill Book Company, Inc.

The use of new tools in the art of electrical engineering is necessary and justifiable if they better aid development. The increased complexity of many electrical problems has brought about the greater use of vector analysis in their solutions and has led to the development and application of vector algebra and vector operators as practical and convenient mathematical tools.

In this well-written book Dr. Colebrook has developed the principles of the rotating vector and has applied them to the solution of alternating current and transient problems. Vectors and vector operators are clearly explained and a series of chapters is devoted to their application to series and parallel circuits with lumped and distributed constants. Further than this vector analysis is applied to transient problems and to the solution of problems associated with symmetrical polyphase systems. The method of treatment is clear and concise and the contents are sufficiently detailed to give students and engineers a fundamental grasp of the subject. It is a book that can be mastered readily and should fill a want in the colleges and in the libraries of engineers.

Metallurgy of Aluminum and Aluminum Alloys

By R. J. Anderson. 912 pages, illustrated. New York: Henry Carey Baird & Company.

This is a thorough and complete treatise on aluminum and aluminum alloys from the standpoint of a practical-minded metallurgist. The sources of the ores, the manufacturing processes used, the uses and properties of aluminum under different conditions of application and manufacture and a splendid treatment of the alloys afford evidence of the scope of the work. Though not treated at length, the electrical applications of aluminum and aluminum alloys are mentioned, and a fundamental groundwork is afforded for measuring further possibilities of these materials in the electrical industry.

The corrosion of aluminum and processes used in the foundry in rolling, casting and other ways of manufacturing the many devices using the material are important aspects of the subject which the author has treated at length. All sources available have been searched for material, and this authoritative and comprehensive work should prove very valuable as a textbook and reference work.

Electrical Machinery Erection

By Terrell Croft. 214 pages, illustrated. New York: McGraw-Hill Book Company, Inc.

The mechanical features of unloading, moving and installing electrical machinery are treated in this very practical work. Care and precaution in handling machinery are necessary elements on many jobs, and the author very largely tells the story of how to do this correctly by the use of excellent illustrations. The proper mounting of motors and other electrical machinery is treated at length, and the whole work will be a welcome addition to the practical series of textbooks written by Mr. Croft.

Der Elektrische Unfall

By Prof. Dr. Med. Stephan Jellinek. 142 pages, 25 illustrations. Leipzig and Vienna: Franz Deuticke.

It is not often that a practicing physician is at the same time an experienced electrical engineer. It took a writer who combines these qualifications to prepare this book on electrical accidents, in which both engineering and medical aspects receive expert treatment. Yet the author has tried so to present both parts of his subject that neither the medical reader nor the technical man will feel that the other part of the story is entirely beyond his knowledge. The history of electrical accidents is usually distorted to some extent by intentional or unintentional exaggerations. To avoid the slightest doubt as to the authenticity of all details given, the author mentions only cases that came to his own knowledge during his 25 years of service with the

city of Vienna as court expert in all kinds of cases involving electrical accidents.

The chapters of the book cover the various phases of an accident, such as the material causing it, the person injured, the nature of the injury, apparent death, and resuscitation. Every chapter is studded with examples of actual happenings serving to illustrate what is meant. Some of the photographs used, while showing in a way no doubt excellent the exact nature of the injury, may tax the nerves of a technical reader somewhat more severely than the diagram of a cross-section through a power house. Throughout the book the author deplores the absence of more vigorous efforts at resuscitation, and he is of the opinion that many a victim could have been saved if the proper method of revival had been kept up long enough. Several cases are mentioned where the victim was left alone because a physician, misguided by a faulty diagnosis, declared the man dead. The book should be of great value to the welfare department of all electrical enterprises. It will also show men of the medical profession how to diagnose and treat electrical injuries, which form, pathologically, a class by themselves. A. P.

Construction et Exploitation des Grands Réseaux Electriques à Haute Tension

Proceedings of the 1923 session of the international conference on large electric high-tension systems. 1,200 pages, 400 illustrations. Paris: Secrétariat de la Conférence Internationale. Price, 120 francs.

All electrical engineers know of the international conference on large electric high-tension transmission which has for its object the study of all the questions connected with the construction and operation of transmission lines, and which has already held three sessions—the first in 1921, the second in 1923, while the third session has just been held this past June in Paris.

Twenty-three countries have participated in the conferences, in which are represented at this time fifty technical societies of electrical engineers and at the sessions of which nearly two hundred delegates have been present.

The proceedings of the session of 1923 make up a handsome volume which comprises, first, the complete text of the fifty papers presented at the conference and, second, the stenographic record in full of the discussions which took place. There will be found in these proceedings the most recent and complete information upon everything which concerns the production and distribution of electrical energy, in particular information upon experiments with and the service of porcelain insulators, the construction of towers, the operation of long transmission lines, the construction of open-air substations, oil circuit breakers, the construction and employment of high-tension cables, the operation of interconnected networks, the grounding of the neutral, protection against overvoltages, etc. The reports and the discussions summarize the practice of twenty different countries and of many hundreds of engineers and industrial executives. The book will be very useful to every electrical engineer and every one particularly concerned with the operation of transmission lines.

Transmission Circuits for Telephonic Communication

By K. S. Johnson. New York: D. Van Nostrand Company. 326 pages, illustrated. Price, $5.

There has been a definite need for a book devoted to a more complete analysis of electric circuits which to a large extent has been met by Mr. Johnson. Although intended primarily for communication engineers it contains much that may be applied by power engineers.

The importance of the "Reciprocity Theorem" and "Thévenin's Theorem" is well brought out; the illustrations are especially convincing. The treatment of transformers is quite different from that usually found in textbooks and for communication purposes is to be preferred. The point of view presented leads to a better understanding of the purpose of transformers in connecting circuits having different impedance characteristics. The chapter dealing with "Transformer and Transition Losses" contains much of interest and value. However, it is questionable whether "transformer loss" is a proper designation for the losses which are eliminated by the insertion of an ideal transformer. A more acceptable statement is to be found near the middle of page 46.

The numerous illustrative problems presented are given in sufficient detail to be of real assistance. In the short chapter on "Resonant and Anti-Resonant Circuits" a number of singular properties of parallel circuits are pointed out which are not found in other books. It would appear that resonance should be defined on the basis of the impressed electromotive force and line current being in phase so that the definition would apply to all circuits regardless of the arrangement of the elements. Where based on minimum impedance series and parallel resonance have nothing in common and the term "Anti-Resonance" must be introduced. In parallel circuits it should be observed that unity power factor and maximum impedance do not in general occur at the same frequency.

The author's extensive experience with selective networks is reflected in his masterly presentation of the theory and design of electric wave filters. The various filter structures with their attenuation characteristics, shown on pages 183 to 185, are useful in indicating how a given result often may be obtained by widely different circuit structures. Attention is called particularly to the discussion of "Equivalent Impedance Networks" and the equations in Appendix D showing the relation between constants of equivalent networks, that is, circuits having identical impedance characteristics for all frequencies. This is a valuable contribution to our knowledge of circuit phenomena for which the author is to be commended.

Book Notes

Electricity Meter Practice. By H. G. Solomon. London: Charles Griffen & Company, Ltd. Philadelphia: J. B. Lippincott Company. 189 pages, 58 illustrations.

This is an elementary handbook on the principles of operation and testing of direct-current and alternating-current meters for the use of meter attendants, junior electrical engineers and students.

Electrolytic Separation of Magnesium from Magnesia. By Ichitaro. Sakai, Japan. 159 pages, 28 illustrations.

In this comprehensive book the author treats of the preparation of magnesium chloride from magnesia or calcined magnesite for the electrolytic process, the relation of its yield to the process and materials used, the factors entering into the electrolysis of magnesium chloride, the electrolysis of magnesia or calcined magnesite in a fused medium and the production of magnesium-aluminum alloy by electrolysis of magnesia-fluoride mixtures.

Chemistry of Engineering Materials. Second edition. By R. B. Leighou. 538 pages, illustrated. New York: McGraw-Hill Book Company, Inc. Price, $4.

This good textbook on the chemistry of engineering materials has been largely rewritten and much new material has been added. It covers in text style water for steam generation, fuels, refractories, metals, corrosion of iron and steel, foundry sands, stones, lime and cement, clays, paints, lubricants, insulating materials and electric cells among other things. It should be a very useful addition to college books and for general reference.

The Engineering Index for 1924. New York: The American Society of Mechanical Engineers. 711 pages.

In selecting the articles to be indexed in this volume more than 1,300 periodicals, reports and other publications received by the Engineering Societies Library during the year have been reviewed.

Mechanical Underground Loading in Metal Mines. By Charles E. Van Barneveld. Rolla, Mo.: Mississippi Valley Station of United States Bureau of Mines and Missouri School of Mines and Metallurgy. 639 pages, 226 illustrations.

A very detailed and comprehensive investigation has been made by the author of underground loading in metal mines. Four general types of loaders—scrapers, shovels, conveyors and bucket conveyors—are considered and compared as to mechanical principles, application, character of material handled and capacity.

Market Analysis. Its Principles and Methods. Second edition. By Percival White. McGraw-Hill Book Company, Inc., New York. 438 pages. Illustrated.

The business of selling has become scientific and codified, and a thorough revision of this pioneer text presents the best practice in market studies. The survey of markets is fundamental to sales, and the author has made a guide for manufacturer, salesman, advertising agency and others interested in the scientific analysis and organization of markets. It contains general principles, but in addition specific material that shows how to apply principles to secure practical results.

Corrosion-Resistant, Heat-Resistant and Electrical Resistance Alloys. Philadelphia: American Society for Testing Materials. 269 pages, illustrated. Price, $2.

This book is a reprint of thirteen papers presented and the discussion thereon at a symposium on the above subject held at the annual meeting of the society in June, 1924. Many of the papers contain new and hitherto unpublished data. Resistances to corrosion of a variety of alloys in various media are discussed in detail, and a number of problems involved in the use of metals at high temperature are covered.

Fundamental Principles of Generators and Motors. By Prof. F. E. Austin. Hanover, N. H.: 198 pages, 48 illustrations. Price, $2.50.

The author considers the qualitative phenomena and principles of electrical machines and apparatus with particular regard to quantitative results and efficiencies. The book is divided into twenty-two major sections called "lessons," each with a set of practical examples.

Transmission Towers. Pittsburgh: American Bridge Company. 177 pages, illustrated.

For transmission engineers this little data book will be found filled with very valuable information. Aspects of steel tower and pole design, installation and maintenance, fundamental design, formula for steel structures, anchor and footing data, location and clearance specifications, erection of structures and loading are a few of the many matters treated.

News of the Industry

New Ontario Project to Produce 400,000 Hp.

Hydro-Electric Commission Authorized to Carry Out Development Which Will Cost $20,000,000

THE Ottawa Valley, in the vicinity of Ottawa, Canada, is to be the scene of one of the most gigantic power schemes that has ever been undertaken in Canada. According to an announcement just made, the Ontario Hydro-Electric Power Commission, to carry out its authorized power development scheme on the Ottawa River from Rocher Fendu Rapids to Carillon Rapids, a distance of about 28 miles, will spend in the neighborhood of $20,000,000, and the amount of power to be generated will be from 300,000 to 400,000 hp. The required order-in-council has been passed authorizing the Hydro commission to go ahead with the scheme, which has for its object the supplying of eastern Ontario with electrical energy.

It is believed that from three to five years will be required to carry out the scheme in its entirety. It is planned to have power development works set in operation at five of the most important power developing points on the Ottawa River. The points at which it is proposed to erect the new power stations are, first, Rocher Fendu Rapids, about 58 miles north of Ottawa; second, Cheneaux Rapids, about 52 miles from Ottawa; third, Chats Falls, about 20 miles from Ottawa; fourth, Deschenes Rapids, just outside the city; fifth, Carillon Rapids, about 70 miles east of Ottawa.

With the first three units, Rocher Fendu, Cheneaux Rapids and the Chats Falls, in operation, it is likely that a huge transmission line running from the vicinity of Chats Falls to a point between Prescott and Brockville, a distance of about 85 miles, will be constructed and the power sent all along the St. Lawrence River front to as far as Toronto. The likely first development will be at the Deschenes Rapids.

When asked for an outline of the program of procedure, Hon. J. B. Cooke, a member of the Ontario Hydro Commission, said Ottawa wanted 20,000 additional horse power, and as Deschenes Rapids was the nearest source of supply, he expected it would be the first to be developed.

New York City Opposes All Up-State Mergers

It is unlikely that the corporation counsel of the city of New York will file a separate brief in opposition to the consolidation of the Capitol district power companies into the Mohawk Hudson Power Corporation, the brief recently filed in the Buffalo, Niagara & Eastern Power Corporation matter being deemed sufficient to apply to all similar cases in so far as the position of the city of New York is concerned. The brief filed by the city opposing the Buffalo, Niagara & Eastern Power Corporation merger was abstracted fully in the ELECTRICAL WORLD of July 11, page 83, and the reasons given for the city's opposition to that merger apply fully to other like mergers contemplated.

San Francisco Asks Rate Reduction

Charging that the Pacific Gas & Electric Company and the Great Western Power Company are earning in excess of 8 per cent, the city of San Francisco has filed a petition with the Railroad Commission of California asking for a hearing and the downward revision of light and power rates in San Francisco. The petition sets forth that for 1922 the revenue of the Pacific Gas & Electric Company was $21,483,700 and in 1924 it was $26,612,088; that the Great Western Power Company in 1922 earned $5,330,000 and received $7,322,562 in 1924. The petition states that the 1922 revenue of these companies was in accord with the allowable 8 per cent return, but that a greater return was made in 1924. No action has been taken by the commission to date.

Further Interconnection by Oregon Companies

Work is under way by the Portland Electric Power Company, Portland, and the Mountain States Power Company, Albany, Ore., which will close, about October 15, 1925, one of the two remaining gaps in the transmission systems between the Canadian and Mexican borders. The gap to be closed is that about 18 miles in extent between Salem and Independence, Ore. Formal announcement of this step in interconnection in the Northwest was made recently on completion of the contractual provisions of the tie-in between the two companies, which, in general, provide for an interchange of current mainly for emergency purposes in any amount up to the capacity of the connecting auto-transformer.

The actual point of contact between the systems of the two companies will be at a new steel switchyard under construction by the Portland Electric Power Company at West Salem. This structure is designed with positions for four radiating lines—one for a tie line with the Portland company's steam plant at Salem, one for the Southern Pacific's electric railway feeder, one for the new 57,000-volt transmission line from Portland to Salem, now under construction by the Portland company, and one for the new 66,000-volt transmission line of the Mountain States Power Company from Independence. A 7,500-kva. auto-transformer will be located at this switchyard between the last two lines.

Conowingo Hearings Resumed

Pennsylvania Water & Power Company Asks Federal Injunction to Prohibit Construction of Proposed Dam

HEARINGS on the Conowingo power project will be resumed this week in Philadelphia before the Pennsylvania Public Service Commission, the Maryland Public Service Commission and the Federal Water Power Commission.

At the last hearing a few weeks ago it was announced that engineers of the Philadelphia Rapid Transit Company, which objects to the project, would be given an opportunity to examine engineers of the Philadelphia Electric Company, promoters of the development, on revisions in construction plans.

Application by the Pennsylvania Water & Power Company of Holtwood, Pa., for an injunction prohibiting construction of the dam, in the federal court at Baltimore on July 13, however, has started reports that the Philadelphia Rapid Transit Company is about ready to abandon its opposition to Conowingo.

The Pennsylvania Power Company, which owns the plant at Holtwood, from which Baltimore gets power, asks the federal court to restrain the Conowingo promoters from building a dam with a crest elevation of more than 103 ft. Threat to resort to injunction proceedings was made by the Holtwood company on the eve of the first hearing here several months ago.

It was asserted, however, that the application for an injunction would have little effect on Conowingo. Under revised plans the dam would be built 86 ft. high and gates above the dam would permit the storage of water to a 108-ft. crest.

It was contended by officials of the Conowingo company that since the company has no intention of building a dam higher than 86 ft., there will be no case for the Holtwood company to fight. An injunction might be obtained prohibiting the closing of the gates above the dam when water had reached 100 ft., it was added, but even then there would be only the question of damages to be settled.

The Holtwood company contends that a dam higher than 100 ft. would flood part of its property near McCully's Falls, below Holtwood.

100,000-Hp. Hydro Plant at Louisville Dam

As noted in the ELECTRICAL WORLD of July 11 the acting Secretary of War has approved a plan for increasing the height of Dam No. 41 in the Ohio River at Louisville. This will make possible the development of 350,000,000

kw.-hr. annually and will simplify navigation in the Ohio River. The Corps of Engineers will begin at once the work of raising the dam so advantage may be taken of the unusually favorable season prevailing on the Ohio.

The power project will be handled by the Louisville Hydro-Electric Company. The development is one that can be handled to advantage only by a company with ample steam plant facilities. It is planned to install machinery sufficient to generate 100,000 hp. The hydro development will cost $7,500,000, the Byllesby Engineering & Management Corporation estimates, and power will be available late in 1928 or early in 1929.

Ohio Electric Men Meet

Commercial Activities Lead Discussion in First Annual Convention of Newly Formed East Central Division—Engineering, Financial and Rural Service Problems Ably Presented

A STANDARD of excellence was attained in the first annual convention of the East Central division of the National Electric Light Association at Cedar Point, Ohio, July 14 to 17, that does credit to its forerunner component, the Ohio Association, and demonstrates the added impetus created by including West Virginia and Kentucky.

President T. O. Kennedy in opening the convention referred to the construction of notable steam and hydro plants in this district, one of which has a test economy of 11,600 B.t.u. per kilowatt-hour, and of division-wide interconnections involving eight utilities. Electricity for industrial heat applications and power purposes is firmly established and industrial executives are generally favorable to purchased power. On one system the annual sales per capita have reached 1,550 kw.-hr. Personal attention of executives was urged by Mr. Kennedy in solving the problem of rural service, otherwise illogical and uneconomical measures may be forced on them.

Division of inductive co-ordination costs, exchange of data, necessity of studying train control exposures, legal decisions, and existence of joint usage involving power circuits above 5,000 volts were discussed by Prof. A. M. Wilson. Standardization of adjustments in inductive co-ordination was considered impracticable by F. M. Howard and Mr. Keyes. Allocation of costs must be based on equities and not pocketbooks. W. H. Snook advocated the principle of least cost.

The effect on engineering practices of higher fuel, labor and material costs, substitution of purchased power for isolated plants, and combination of properties was traced by C. F. Hirshfeld of the Detroit Edison Company. Data comparing losses in powdered fuel and stoker installation, relative over-all costs thereof and conditions under which it is economical to spend money for higher economy were interpreted. The over-all costs of stoker and powdered fuel plants were shown to be quite close together, with stokers appearing favorable with higher cost and higher grade fuels and powdered fuel favorable for the lower grade and low cost coals. L. E. Brown and William Schuler presented reports of the power production committee and development of electrical apparatus respectively.

COMMERCIAL SESSIONS DRAW INTEREST

S. D. Heed of Cincinnati, in a report on Commercial Section activities on Wednesday morning, urged organized sales effort, suggesting that if any one questioned the need of it they should check the number of customers per population, consumption per customer and illumination in stores, industries and streets in their territory.

The commercial program was in the nature of a symposium in which various men from different companies gave their experiences. E. L. Canfield, Canton, cited ultimate sales results from showing customers how to use present store-lighting equipment to best advantage. H. W. Derry, Cincinnati, explained a co-operative store-lighting campaign which sold 5,000 fixtures representing a load of 750 kw., bringing an energy revenue of about $37,500 a year. L. W. McLellan, Louisville, developed a window-lighting revenue of $3,500 per month in eighteen months in towns of 2,000 to 10,000.

C. L. Dunn, Cleveland, increased domestic revenue 20 per cent per year through six campaigns in two years. Kitchen units, duplexalites, table units and fixtures were involved in these campaigns. Customers were also provided with adequate lamps averaging 105 watts per customer and 60 watts per lamp. Preliminary announcements regarding a national industrial lighting campaign were made by Mr. Derry and H. Logan. H. N. Wood referred to efforts to co-ordinate power sales in this division. Various phases of commercial activity were further discussed by J. B. Wilson of Massillon, T. L. Philips of Cincinnati and George E. Miller of Cleveland, who analyzed the progress made in electric refrigeration.

Thursday morning was devoted to Public Relations. Among those who presented papers were L. B. Herrington, on "Public Relations of a Utility the Key to Its Success," P. H. Whiting on "Customer Ownership," and Colonel Dudley J. Hard on "Co-operation with Educational Institutions." Miss Helen C. Steiner of the Ohio Public Service Company, in presenting the report of the Women's Public Utility Information Committee, urged increased activity and enlarged opportunity for women in the public utility field.

Thursday afternoon was devoted to a technical session and included a report of the overhead-underground systems committee by G. M. Miller. Papers on "Installation and Operation of 66-Kv. Lead-Covered Cable," by D. C. Ober, and "Load Dispatching and Allocation of Load on Interconnected Transmission Systems," by Mr. Williams were also presented.

Friday morning's session was featured by the report of the rural service committee presented by J. B. Johnson of Elyria, who declared that less than 10 per cent of the 500,000 farmer families in Ohio, Kentucky and West Virginia received electric service and urged that a payment plan be devised which would enable the farmers to take central-station service as rapidly as possible.

Dr. E. A. White, chairman of the national committee on the relation of electricity to agriculture, described the committee's work, and B. P. Hess told of the survey of the committee on the relation of electricity to agriculture which was being made in the East Central Division.

Newly elected officers of the division for the coming year are W. R. Power, Huntington, W. Va., president; J. P. Pope, Lexington, Ky.; C. I. Weaver, Springfield, Ohio, and G. E. Miller, Cleveland, Ohio, vice-presidents.

Virginian Railway Orders 36 New Electric Locomotives

The Virginian Railway has applied to the Interstate Commerce Commission for authority to obligate itself for the purchase of thirty-six electric locomotives to cost $4,815,410. The locomotives are to be manufactured by the Westinghouse Electric & Manufacturing Company and are to be of split-phase, constant-speed type of 11,000 or 22,000 volts.

The Norfolk & Western has also filed its formal application for authority to lease the Virginian Railway. The purpose is stated as a desire for a western outlet, in connection with which it is proposed to construct 53 miles of line from Elmore to Gilbert and thence to Wharncliffe, W. Va. One of the economies which will be effected, it is stated, is the utilization by the Norfolk & Western of the excess power and electric locomotives of the Virginian Company, in connection with the electrification of a portion of its own lines.

Byllesby Interests Purchase Wisconsin Public Service

H. M. Byllesby & Company have announced the acquisition of the Wisconsin Public Service Corporation from Clement C. Smith of Milwaukee and his associates. The company serves nearly 100 communities in Wisconsin and Michigan with electricity and gas and it is reported that the amount of the transaction was nearly $26,000,000. The company's subsidiaries, the Menominee & Marinette Light & Traction Company, the Northeastern Power Company, the Oslo Power & Light Company and other smaller organizations, were included.

The Wisconsin Public Service Corporation and its subsidiaries had gross earnings for the year ended May 31, 1925, of $3,760,000 and served a population of 325,000 in an area extending north from Sheboygan across the Michigan border and from Lake Michigan west to Oshkosh, including the cities of Oshkosh, Green Bay, Manitowoc, Sheboygan, Marinette and Menominee. The properties include six hydro-electric generating stations with a capacity of

approximately 35,000 hp., three steam stations with 25,000 hp. capacity installed and a number of undeveloped water-power sites. The transmission system consists of 350 miles of high-tension lines with local distribution systems.

The area served is one of the richest in Wisconsin, including the famous Fox River Valley farming district. The Northern States Power Company has been under Byllesby control for some time and, with the Wisconsin Public Service Company, will form one of the largest and strongest utility groups in the North Central States.

Power Corporation of Canada Controls Hamilton Utility

It is reported that the Power Corporation of Canada, recently formed by Nesbitt Thomson & Company as a holding and management company for utilities in which they have a financial interest, has secured control of the Dominion Power & Transmission Company of Hamilton, Ont., which in turn controls the Hamilton Cataract Power, Light & Traction Company, the Hamilton Electric Light & Power Company, the Hamilton Street Railway Company, Ltd., the Hamilton & Dundas Street Railway Company, and other smaller subsidiaries.

The Dominion Power & Transmission Company develops hydro-electric power at Decew Falls, Ontario, which is regarded as the most economical development in the Niagara district. With its subsidiaries the company has a generating capacity of about 50,000 hp. in water power and 23,000 hp. in steam equipment serving Hamilton, Brantford, St. Catherines and surrounding territory.

The Winnipeg Electric Company, also controlled by the Power Corporation, is completing negotiations with the municipal hydro company by which the private plant would become a large wholesaler of energy, turning over much of its distribution system to the city. Valuation of the company's property to be taken over is proceeding rapidly and the completed agreement will be presented to the City Council shortly.

Metric System Urged

Metric Association Meets at Lake Placid—Advantages of System Discussed

THE great advantages of the metric system over other methods of measurement in many different fields were brought out in a series of papers presented at the meeting of the Metric Association held at Lake Placid, N. Y., July 10 and 11.

Theodore H. Miller of the De Laval Separator Company, in urging the adoption of the metric system, said: "No radical departure in machine design, no scrapping of vast quantities of machinery would result from its adoption." E. L. Robinson of the General Electric Company said that the company was ready to change its entire works to the metric system as soon as it was adopted throughout the United States.

Another interesting paper was read by F. J. Schink of the American Engineering Standards Committee discussing the progress made in the international standardization of screw threads. A number of other speakers, including Eugene C. Bingham of Lafayette College, George F. Kunz, president of the association, and Henry D. Hubbard of the Bureau of Standards, discussed the advantages of the system in eliminating waste in industrial and scientific processes and in promoting international commercial relations.

An entertainment program formed part of the convention and included a dinner of the association the evening of July 11. About 150 members and guests attended the convention.

Applications Before Federal Power Commission

The Ventura Power Company has applied to the Federal Power Commission for preliminary permits for two hydro-electric developments in California, one on Sespe Creek in Ventura County near Sespe and Filmore, the other on Piru Creek in Ventura and Los Angeles counties near Piru.

The Southern Sierras Power Company has applied for a preliminary permit to build a transmission line in San Bernardino County, California.

A license held by the Southern California Edison Company has been amended to authorize the construction of the transmission line from the Big Creek power house No. 3 to permit connection with the Eagle-Bell transmission lines.

The city of Lewiston has withdrawn its application for a preliminary permit covering a dam in Clearwater River.

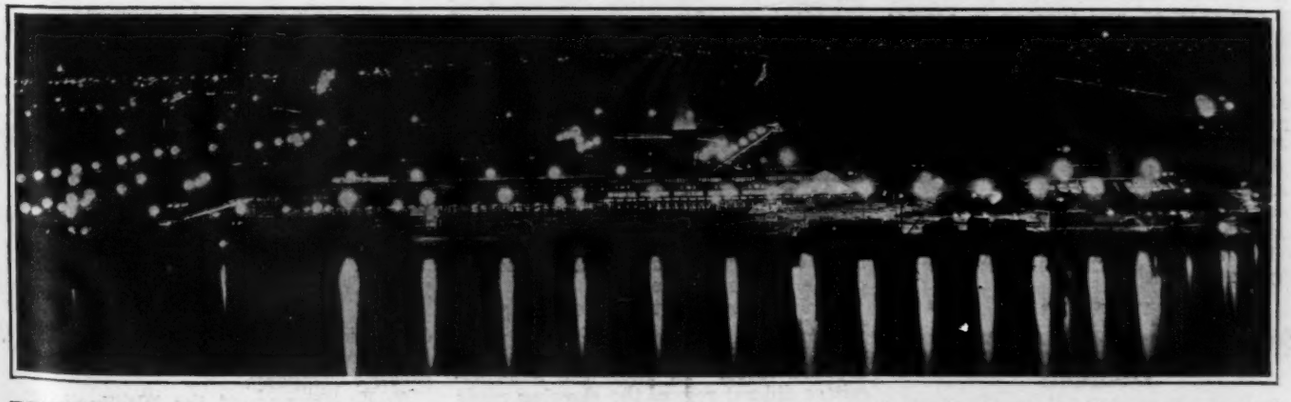
The Jo Reynolds Mining, Milling, Drainage, Tunnel & Transportation Company of Denver has applied for a license covering an existing plant on Clear Creek, a tributary of the South Platte River, between Dumont and Lawson, Col. The 112 hp. of primary power is used by the owner for mining purposes.

Sale of Muscle Shoals Power Criticised

Sale of power at Muscle Shoals for 2 mills a kilowatt-hour is being criticised in certain quarters as an inadequate return. In defense of the arrangement with the Southeastern power companies, officers of the Corps of Engineers point out that ample opportunity was given all those interested to offer a higher figure. No one else was found who was willing to pay anything for power under the conditions of delivery which must prevail during the testing period. Two mills was all the power companies would pay when there was to be no assurance as to the continuity of operations.

During the lower-water season, which began unusually early this year, it is necessary to operate the steam plant at Muscle Shoals at capacity. When deliveries of hydro power begin it will be possible to suspend a corresponding amount of generation at the steam plant, but since there is no assurance that the hydro power may not be cut off at any minute, it will be necessary to keep up steam in all boilers. It will not be possible to operate with less personnel, nor will it be possible for the Alabama Power Company to reduce

Illumination of Long-Bell Lumber Company's Plant on Columbia River



WITHOUT the aid of electricity, the night operations at the great manufacturing plant of the Long-Bell Lumber Company in Washington State would be greatly hampered. As it is, night is transformed into day and work can go ahead at top speed. In the foreground of the illustration is the Columbia River. The single light above the power house to the right comes from a marine lamp placed on top of one of the two 300-ft. stacks. The lights in the background are those of Longview. The photo was taken from across the river. A series of articles on the electrification of this plant appeared in the ELECTRICAL WORLD for January 17, 24 and 31 and February 7.

its coal mining operations. The only saving which will be made would be in the actual reduction in coal consumed.

Both Colonel Spalding and Major Tyler, who have national reputations as hydro-electric engineers, made careful calculations and agreed that 2 mills is a reasonable rate. Even were it inadequate, that rate was the absolute limit that the power companies were willing to pay. It was a case of accepting that offer and returning some $500,000 to the treasury, or receiving nothing for the power. In the opinion of one officer the government would have been justified in paying something to the power companies for the privilege of testing out the equipment under load, rather than to have attempted tests on a water rheostat. Moreover the power companies are furnishing equipment, including transformers, which represent an expenditure of $400,000.

Federal Power Board Ruling on Fixed-Capital Accounts

B. Frank Morgal, the chief of the bureau of accounts and statistics of the Public Service Commission of Pennsylvania, has questioned the authority of the Federal Power Commissioner to require the elimination from the fixed-capital accounts of licensees of items which, purporting to show actual legitimate cost, are not properly includable in net investment. O. C. Merrill, the executive secretary of the commission, has made an exhaustive reply, from which the following is an extract:

"Just how far this commission would go in prescribing the particular account to which should be charged items eliminated from the fixed-capital accounts of licensed projects cannot be definitely said in absence of the facts in particular cases. The chief interest of the Federal Power Commission is in the accounts of licensed projects and particularly in the fixed-capital accounts of such projects. The balance in the fixed capital accounts is the basis for determination of the net investment, of the fair return, which is a factor in the determination of the net investment, and of the current charges for depreciation.

"In fact, practically the entire scheme of administration of the federal water-power act, after the completion of construction and placing in service of a licensed project, rests upon the amount included in the fixed-capital accounts. There is no provision in the act for the valuation of licensed projects other than those already constructed before license is issued, and after such value or the actual legitimate cost of projects constructed new under a license has been determined and has been entered upon the fixed-capital accounts there is no authority for changing the figures."

Engineering Services More in Demand

A survey of national conditions affecting engineering employment shows an optimistic situation, declares the American Association of Engineers. June activities have been good and future prospects are even better, though a slight depression has been felt during the month in the manufacturing field. The most favorable factor in the industrial situation is that considerable additions, betterments and repairs are getting under way. The general feeling throughout the industrials seems to be that of watchful waiting.

The call for engineers during the month has particularly emphasized the demand for experience. The 1925 group of graduate engineers, in general, have been offered a good opportunity for acquiring experience. All indications point to a very good field and demand for engineering employment in the near future.

Chicago Utilities Plan for 4,500,000 by 1950

The utilities supplying Chicago with electricity, gas, telephone and transportation service are estimating a population of 4,500,000 for Chicago in 1950, according to a report recently published by the public service group of the Chicago Association of Commerce.

The electrical utilities are expected to show the greatest increase in investment. There is at present an investment of $166,577,490, or $56.21 per resident, and the total investment in 1950 is expected to amount to $490,000,000, or $108.88 per resident. The average use of electricity in Chicago in 1924 was 94 kw.-hr. per inhabitant, but it is anticipated that this figure will be doubled and amount to 186 kw.-hr. per inhabitant by 1950.

Legislation on Metric System Seems Unlikely

(By Our Washington Correspondent)

Preparations being made for another effort to secure metric legislation have less chance of succeeding than when the effort was made in 1921, it is believed in Washington. Ordnance officers think the chief objection to the English system has been met by the discarding of the fractions and putting decimal divisions of the inch into general practice.

Developments since the war, it is declared, have placed an overwhelming preponderance of world trade in the hands of the non-metric countries with the result that the use of the English system is increasing throughout Europe. It is making rapid strides in Italy, where formerly there was a fairly even division between the use made of the two systems. Progress is being made by the English units even in France. Recent visitors in French machine shops have found large use being made of equipment designed for the use of the English system.

In 1921 the effort to secure legislation did not progress beyond the subcommittee of the Senate committee on manufactures. In fact, the sub-committee did not regard the showing made by the proponents of the legislation seriously enough to formulate the adverse report which it had been decided to make.

The recent announcement that metric legislation would be pushed at the forthcoming session brought out an expression of opinion from a well-informed source that the chance of securing the compulsory use of the metric system in this country is quite hopeless.

Nation's Industries Support Standardization Movement

The National Standardization Movement is being taken up by the major industries all over the country and is showing promise of savings aggregating many millions of dollars, as shown by the 1925 Year Book of the American Engineering Standards Committee issued July 14.

Officially participating in the work of this committee, which acts as a national clearing house for engineering and industrial standardization and is the means whereby nation-wide approval and acceptance can be secured for suitable standards in industry, are 245 national trade, technical, industrial and governmental organizations. Among these organizations are the National Electric Light Association, American Institute of Electrical Engineers and the Electric Power Club.

"National standardization has possibilities of saving the nation hundreds of millions of dollars annually," stated C. E. Skinner, chairman of the American Engineering Standards Committee. The committee's Year Book shows that sixty-eight standards have already been approved and work on about 100 other projects is actively under way. An extremely wide range of activities is represented in the technical projects, which include thirty-two in civil engineering and building trades, twenty-six in mechanical engineering, seventeen in electrical, four in automotive, nine in transportation, one in shipbuilding, nine ferrous metallurgy, fourteen non-ferrous metallurgy, twelve chemical, two textile, sixteen mining, five wood, one pulp and paper, twelve miscellaneous. Among the more important projects in the electrical field that are being carried on by the committee are the establishment of specifications for insulated wires and cable, and for rating electrical machinery, and the forming of safety codes concerning installation and control practices in connection with electrical equipment.

In order to keep industrial executives in touch with the movement, so far carried on largely by technical men, the following advisory committee was recently formed at a conference of first-line industrial executives held in New York recently:

J. A. Farrell, president U. S. Steel Corporation.

George B. Cortelyou, president Consolidated Gas Company of New York.

J. W. Lieb, vice-president New York Edison Company.

L. F. Loree, president the Delaware & Hudson Company.

Gerard Swope, president General Electric Company.

C. E. Skinner, of the Westinghouse Electric & Manufacturing Company, is chairman, and C. R. Harte, of the Connecticut Company, is vice-chairman of the American Engineering Standards Committee.

Briefer News

American Electric Power Purchases Rocky Mount (Va.) Plant.—It is reported that the American Electric Power Company of Philadelphia has purchased the Rocky Mount Light & Power Company, formerly owned by W. P. Angle of Rocky Mount, Va. Additional generating equipment will be installed and improvements to the distribution system made.

Klickitat Power Grant Is Asked.—A. Murray and M. Lynatt of Portland, Ore., have applied to the Oregon State Supervisor of Hydraulics for permission to divert 10,000 sec.-ft. of water from the Klickitat River for power purposes. The capacity of the proposed plant is 60,000 hp. with a 150-ft. head, and development costs are estimated at from $4,000,000 to $5,000,000.

Electrified Railroad Extension in North Carolina Considered.—Extension of the Piedmont & Northern Railroad from Charlotte to Winston-Salem and the completion of two unfinished links in the line, at a cost of from $10,000,000 to $15,000,000, is being considered by the J. B. Duke interests, who own the road. The Piedmont & Northern is entirely electrified.

Ohio Towns to Be Served from Transmission Line.—The Ohio Public Service Company has recently purchased the property of the Marblehead Power Company, which serves about 800 customers in Marblehead, Lakeside and Danbury on the peninsula just across the bay from Sandusky. The local plant will be shut down and the territory will be served from the 132,000-volt transmission line now under construction between Lorain and Sandusky.

Enid (Okla.) Votes New Franchises for Oklahoma Gas & Electric Company.—Long-term franchises for electric and gas service without competition were given to the Oklahoma Gas & Electric Company by Enid, Okla., at an election on June 23. A group of Enid citizens recently applied for a franchise for both electricity and gas, but the city voted its satisfaction with the service and rates of the existing company.

Change of Control in Newport News (Va.) Company Possible. — Constant rumors have been heard recently in financial and utility circles to the effect that interests reported to be Stone & Webster of Boston, who recently purchased control of the Virginia Railway & Power Company, are seeking control of the Newport News & Hampton Railway, Gas & Electric Company. The Newport News company serves the territory around Newport News, Va., adjacent to part of the territory served by the Virginia Railway & Power Company. Its properties are valued at between $10,000,000 and $12,000,000 and its acquisition would materially strengthen the position of the Engineers Public Service Company, which was formed by Stone & Webster to take over the stock of the Virginia Railway & Power Company.

Airplanes Used in Tennessee River Survey.—Power producers on the Tennessee River and those contemplating developments on that stream or its tributaries are co-operating closely with the Corps of Engineers in the half-million-dollar survey being made of that basin. As a result the haphazard development of the power resources of the region by unrelated private interests will be avoided and a carefully coordinated plan put into effect which will make it possible to utilize the maximum resources of the stream. Because of the use of airplanes the maps which are being prepared contain a wealth of detail which was not contemplated in the original plans.

Industrial Department Organized by Central Illinois Public Service Company.—For the purpose of assisting the industrial growth of all communities served by the Central Illinois Public Service Company, Springfield, Ill., an industrial department has been organized. This department will make complete industrial surveys of the towns in the company's territory and will present to executives of companies seeking a new location information bearing on the suitability of these communities for industrial enterprises. A. R. Gwinn is manager of the New department and Roy H. Campbell, Jr., is industrial agent.

Plans Being Made for New Plant on Patsilaga River.—The River Falls Power Company is now having plans and surveys made for its new O'Neal hydro-electric station on the Patsilaga River near Gaunt, Ala. The new plant will have a capacity of 7,500 hp., a storage lake of 10,000 acres area and an effective head of 50 ft. Upon completion of the O'Neal plant the company will have a total capacity of 18,500 hp. The town of Luverne, Ala., has made a thirty-year contract with the company for power and a 44-kv. line from Brantley to Luverne, a distance of 12 miles, will be built immediately.

Maryland to Investigate Water Diversion at Swallow Falls.—Governor Ritchie has announced that he will request the Maryland Public Service Commission to investigate reported plans of the Youghiogheny Hydro-Electric Corporation to divert the waters of the Youghiogheny River around Swallow Falls in Garrett County by means of a pipe line for a power development. The land around Swallow Falls is now used as a state park and is visited by many people each year. The Governor said: "I am in favor of preserving all of the natural beauties of the state for the enjoyment of the people." C. B. Hawley, head of the contractors for the Youghiogheny River projects, states that while water will be diverted around Swallow Falls, which are merely a series of rapids, the Muddy Creek Falls and the forests surrounding them, which form the most beautiful spot in the district, will not be harmed. The chief forester of Maryland states, on the contrary, that many people visit Swallow Falls who never see the more remote and inaccessible Muddy Creek Falls.

Army Makes Air Maps of Niagara Falls.—The Army Air Service recently photographed the entire crest line of Niagara Falls. From these photographs maps will be made and compared with maps made in 1917, though the latter were not made from the air. This comparison will show the approximate amount of recession since 1917 and will make possible an estimate of the length of time it will take Niagara Falls "to commit suicide."

Southwestern Light & Power Company Purchases Waurika (Okla.) Plant.—The Southwestern Light & Power Company announces the purchase of the Consumers Light & Power Company of Waurika, Okla., subject to confirmation by the granting of a franchise to the purchasing company at a city election to be held at a later date. Waurika will be served by a 10-mile transmission line to be built from Hastings. The present manager, A. D. Kerr, will be retained as manager for the new company.

Oklahoma Towns to Vote on Sale of Municipal Plants—Lindsay, Okla., will hold an election on July 20 on the proposed sale of its municipal plant to the Oklahoma Gas & Electric Company for $50,000 and Kiowa, Okla., is holding a similar election on July 14 to consider the sale of its plant to the Southwest Power Company. Two other towns, Medford and Pondcreek, are also considering the sale of their municipally owned plants to privately owned utilities, though no definite decisions have been made.

Further Extension of Insull Interests in New England Forecast.—The Insull utility interests are said to be negotiating for the purchase of the Montpelier & Barre Light and Power Company of Vermont in addition to several other New England properties recently purchased. The Vermont company owns valuable water-power rights on the Winooski River, six hydraulic stations and one steam station. The generating stations have an aggregate capacity of 16,731 hp. and undeveloped water power of about 3,000 hp. capacity. Total assets are about $6,000,000. The common stock of the company was recently auctioned at Boston at 70¼ per share.

Canada Considers Power Development on Lake in National Park.—The question of permitting the development of power at Spray Lake, Alberta, was discussed in the Canadian House of Commons recently. Some slight opposition to the development on the ground that it would commercialize this section of the National Park had been made two years ago, when the Province of Alberta applied for a license. The Minister of the Interior said that while it was true that there had been some reluctance to consider an application that would interfere with the scenic beauty of the region, such a project would

supply Calgary and possibly intervening towns as far north as Edmonton with power. The leader of the Conservative party also declared that Canada could not set its face definitely for any length of time against the development of power sites.

Cleveland Adopts Big Unit for Street Lighting.—Cleveland is soon to install lighting units equipped with 25,000-lumen (2,500-cp.) "Mazda" incandescent lamps. Two hundred and twenty of these lamps, which are said to be much larger than any previously used in street lighting, will be installed on Superior Avenue. Large suspended lanterns, manufactured by the General Electric Company and known as "Novalux form 23-B," will be used.

Hearing on Valuation of Lines to Be Taken Over by Los Angeles Postponed.—The valuation hearing scheduled for July 6 on the distribution lines of the Southern California Edison Company in the fourteen newly annexed sections of Los Angeles was postponed until November 2 by the State Railroad Commission. This delay will give engineers for the commission time to establish a true value for the property. The communities in which Los Angeles has made application to acquire the equipment are: Melrose, Sawtelle, Rimpau, Evans, Ambassador, Laurel Canyon, Hyde Park, Eagle Rock, Vermont, Lankershim, Providencia, Cienega, Annandale, Wagner and Fairfax.

Amarillo (Tex.) Utility Purchased by Southwestern Public Service Company.—Sale of the electric light and power plant and water-works plant of the City Light and Water Company of Amarillo, Tex., owned by the H. L. Doherty Company of New York, to the Southwestern Public Service Company is announced. The purchase price was approximately $2,500,000. The Southwestern Public Service Company, a subsidiary of the Consolidated Public Service Company of Chicago, has just issued and sold $3,500,000 in bonds, which will be spent in development of the southwestern group of properties. The company is now spending $250,000 at Roswell, N. M., in enlarging its power plant there and building high-tension transmission lines to take care of the irrigation demands in the Pecos Valley and has recently acquired properties at Holbrook, Winslow and Flagstaff, Ariz.

Wisconsin Power & Light Company Acquires New Plants.—Within the past sixty days the Wisconsin Power & Light Company has added eleven local companies, both private and municipally owned, to its rapidly growing system. The plants acquired are the Mauston Electric Service Company, Marquette Electric Company, Interurban Electric Company, Twin Bluffs Electric Company, Monticello & Harrisville Light & Power Company, Fall River Electric Company, Cazenovia Electric Company, Princeton Electric Company, Orfordeville Light & Power Company and the municipal plants at Lime Ridge and Dane. Transmission lines will be built so that the properties taken over will be connected with the company's main transmission system. It is also reported that surveys are now being made by the company on the Wisconsin River at Ferry Bluff, six miles below the Prairie du Sac plant, preparatory to building a new hydro-electric station.

Walla Walla Rate Case Postponed Until August 11.—Hearing on the rates and valuations of the Pacific Power & Light Company, originally set for June 29 in Walla Walla, Wash., has been postponed to August 11 by the Department of Public Works. The postponement was due to the need for the engineers to complete their work compiling data. The complaint on rates and valuations was originally filed by the city of Walla Walla, and many of the towns in south central Washington affected by the controversy over electrical energy supplied by the company joined the complaint. The towns have spent more than $15,000 in compiling data for the case. The complaining towns contend that if the company took a proper valuation of its property rates would be reduced practically 25 per cent.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

International Association of Municipal Electricians—Hotel Statler, Detroit, Aug. 17-20. W. R. Arbuckle, Bayonne, N. J.

Wisconsin Utilities Association, Electric Section—Green Bay, Wis., Sept. 4-5.

Camp Co-operation V (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 8-12. (Society for Electrical Development, New York, is sponsor.)

New England Division, N. E. L. A.—Hotel Griswold, New London, Conn., Sept. 8-11. Miss O. A. Bursiel, 149 Tremont St., Boston.

Society for Electrical Development—Henderson Harbor, N. Y., Sept. 8-12. S. E. D., 522 Fifth Ave., New York.

Pennsylvania State Association of Electrical Contractors and Dealers—Hotel Jermyn, Scranton, Sept. 10. M. G. Sellers, 1202 Locust St., Philadelphia.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 14-17. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers—Benjamin Franklin Hotel, Philadelphia, Sept. 14-19. John F. Kelly, Empire Bldg., Pittsburgh.

Southeastern Geographic Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

American Institute of Electrical Engineers, Pacific Coast Section—Seattle, Sept. 15-17. P. L. Hutchinson, 33 West 39th St., New York.

Great Lakes Geographic Division, N. E. L. A.—French Lick Springs, Ind., Sept. 23-26. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden, Ind., Sept. 23-25. L. W. Davis, 15 W. 37th St., New York.

American Electrochemical Society—Chattanooga, Tenn., Sept. 24-26. Colin G. Fink, Columbia University, New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 1-2. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 5-9. J. W. Welsh, 292 Madison Ave., New York.

National Association of Railway and Utilities Commissioners — Washington, D. C., Oct. 13-16. J. B. Walker, 270 Madison Ave., New York.

Electric Power Club—Briarcliff Manor, N. Y., Oct. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Association of Railway Electrical Engineers—Hotel Sherman, Chicago, Oct. 20-24. J. A. Andrencetti, 413 C. & N. W. Terminal Station, Chicago.

Kansas Public Service Association—Topeka, Oct. 23-24. H. Lee Jones, Topeka, Kan.

Iowa State Association of Electrical Contractors and Dealers—Waterloo, Iowa, Oct. 27.

Westinghouse Awards Memorial Scholarships.—The Westinghouse Electric & Manufacturing Company last week awarded four scholarships, established in 1919 for the benefit of employees or their sons as a memorial to the 5,000 Westinghouse employees who served in the World War. This year's recipients are R. C. Redhead, Webster Groves, Mo.; H. Hamilton, Norwood, Pa.; B. C. Hibler, Turtle Creek, Pa., and Starling Winters, San Francisco. Each scholarship carries an annual payment of $500 for four years, to be applied toward an engineering course in an approved college of the candidate's selection.

New Holding Company Formed in Iowa.—The Central States Power & Light Corporation has been formed recently with headquarters in Davenport, Iowa, and will own the common stock of the Northeastern Iowa Power Company, the Nebraska Electric Power Company, the Central Light & Power Company of North Dakota, the Arkansas Public Service Company, the Southeast Missouri Public Service Company, the Missouri Electric Power Company and the Missouri Power Development Company. The total generating capacity of the properties is about 12,400 hp., 6,400 hp. of which is in hydro-electric and 6,000 hp. in fuel-burning stations. The company will serve about 300 communities with a total of 25,000 customers. T. J. Walsh of Davenport is president and W. C. Tegtmeier is general manager of the new company.

Calumet Gas & Electric Company Purchases Transmission Line Company. The Indiana Public Service Commission has authorized the Calumet Gas & Electric Company to purchase the physical property of the Calumet Power Company at a price set at $1,146,861. The property purchased consists of a 132,000-volt electric transmission line running from the Indiana-Illinois state line to Aetna, Lake County, Indiana, and a substation at Aetna. The purchasing company proposes to continue the line to Michigan City. The commission in granting the petition also authorized the company to issue $2,200,000 in par amount of first and refunding mortgage bonds to finance the purchase and pay for proposed additions and betterments to the property to cost about $241,806.

Men of the Industry

C. H. Minor Heads International General Electric

Clark H. Minor, vice-president of the International General Electric Company, has been elected president to succeed Anson W. Burchard, who resigned as president, though still retaining the chairmanship of the board. Mr. Burchard, who just sailed for Europe, wished to be relieved to some extent of the duties incumbent upon both offices.

Mr. Minor was elected a vice-president of the International in the spring of 1924 and previous to that association had been identified with the Western Electric Company since 1902. After engaging in foreign sales work for that organization in the New York office for some time he was assigned to special work in China and Japan in 1918. Three years later, having completed his work in the Orient, he became European sales manager, the position he occupied at the time of his election as vice-president of the International General Electric.

T. S. Wheelwright Assumes New Duties in Richmond

Thomas S. Wheelwright, who has been succeeded as president of the Virginia Railway & Power Company, Richmond, Va., by Luke C. Bradley, will continue with the company as a director. In further explanation of his relations with the new owners of the property Mr. Wheelwright has announced that Charles A. Stone, chairman of the board of the Engineers Public Service Company, which controls the Virginia Railway & Power Company, had requested him to assist Mr. Stone in the development of several other companies controlled by it, and that Mr. Wheelwright had agreed with him to undertake this work.

Mr. Wheelwright has been with the company at Richmond since 1912. He had been serving Frank J. Gould for some years as general manager and then president of the Old Dominion Iron & Steel Company. Mr. Gould was also largely interested in the railway and power company, and when Mr. Northrop, the former president of the utility, was killed in an automobile accident in 1912, Mr. Wheelwright was offered the place. A loving cup was presented to Mr. Wheelwright by the employees of the company in appreciation of his executive administration since 1912.

As announced in last week's issue of the ELECTRICAL WORLD, **W. E. Wood** was named vice-president in charge of operations, succeeding Fritz Sitterding, and **J. F. McLaughlin** was named vice-president in charge of new business to succeed **G. B. Williams**, who will, however, remain as treasurer of the company. **A. H. Herrmann** continues as secretary and assistant to the president.

The by-laws of the corporation were amended to increase the membership of the directorate from fifteen to seventeen, and the following personnel was elected:

H. H. Hunt, Boston, chairman of the board, succeeding Frank Jay Gould.

Bayard F. Pope of Blodgett & Company, New York, succeeding Nathaniel A. Campbell of New York.

Murray W. Dodge of the Chase Securities Corporation, New York, succeeding George H. Taylor, New York.

Luke C. Bradley, president, succeeding Walter B. Walker, New York, as director.

Henry R. Hayes of Stone & Webster, New York, succeeding W. J. Parrish, Richmond.

Ray Morris of Brown Brothers & Company, New York, succeeding F. Sitterding as director.

Edwin S. Webster, Boston, succeeding Coleman Wortham, Richmond.

George N. Lindsay of Blair & Company, New York, succeeding John C. Easley, Richmond.

William E. Wood, vice-president, now of Richmond.

Charles A. Stone, New York.

The former board of directors resigned in entirety, but the new management declined to accept the resignations of the following, and they will continue in the directorate:

Thomas S. Wheelwright, Richmond.
E. Randolph Williams, Richmond.
Herbert W. Jackson, Richmond.

G. B. Evans New President of St. Louis Utility

George B. Evans has just been elected president of the Laclede Gas Light Company, St. Louis, Mo., to succeed Charles L. Holman, who recently resigned. This promotion to the office of chief executive of the company comes to Mr. Evans after fifteen years of service and follows his occupancy of the office of vice-president and general manager in charge of operations. **Charles L. Holman**, the former president of the St. Louis utility, resigned to become president of the Georgian Manganese Company, which is controlled by the Harriman and Rockefeller interests and was formed to operate a manganese concession in Russia. Mr. Holman entered the service of the Laclede company in 1903 in the capacity of secretary to the president, subsequently being promoted to be secretary of the company and later vice-president and general manager. He was elected to the presidency in 1912.

David J. Loria has resigned as electrical designer of the Public Service Production Company of New Jersey to join the Duquesne Light Company, Pittsburgh, Pa.

Harry D. McKinney has been elected second vice-president and general sales manager of the Driver-Harris Company, Harrison, N. J. Mr. McKinney joined the Driver-Harris Company in 1918 as district sales manager of the New England territory, in which position he served until 1920, when he was transferred to the Chicago sales office as manager. Prior to his association with the Driver-Harris Company, Mr. McKinney was associated with the Westinghouse Electric & Manufacturing Company in various capacities.

Edward F. Ziegler, formerly of the Brooklyn Edison Company, has recently been appointed senior designing engineer for the Philadelphia Company, Pittsburgh, Pa.

Major James R. Werth has been appointed general superintendent of light, power and gas of the Lynchburg (Va.) Traction & Light Company. He had previously served in the construction division of the army, with the Oklahoma Gas & Electric Company and the West Penn Power Company.

T. A. Corby, formerly construction superintendent of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., has been promoted to the position of general superintendent of the Kingston (N. Y.) Gas & Electric Company, which is controlled by the Central Hudson organization.

Dr. George D. Shepardson, head of the department of electrical engineering at the University of Minnesota, has been granted a sabbatical furlough for the year 1925-1926, which will be spent largely in foreign travel. During his absence Prof. F. W. Springer will be acting head of the department.

A. J. Nesbitt of the investment banking firm of Nesbitt, Thomson & Company, Montreal, and **J. B. Woodyatt**, general manager of the Southern Canada Power Company, were recently elected to the board of directors of the Dominion Power & Transmission Company of Hamilton, Ont.

Arlington Bensel, vice-president and sales manager of the Driver-Harris Company, Harrison, N. J., has resigned to take up the sales engineering service of Victor Hybinette for "Hybnickel" and similar products. Mr. Bensel is particularly well qualified to manage the sales end of the business, having been identified with the alloy field for twenty years.

H. B. Vincent, who for many years past has been associated with Day & Zimmermann, Inc., Philadelphia, as engineer of construction and operation, has entered the field engineering service department of the R. Thomas & Sons Company of East Liverpool and Lisbon, Ohio, pioneer designers and manufacturers of high-tension porcelain insulators. In 1911 Mr. Vincent went with Dodge & Day (now Day & Zimmermann) as field engineer. In 1913 he was transferred to the management department at the home office of the company in Philadelphia, where he directed the operation of transmission, distribution and utilization systems of managed properties. He was formerly connected with the Manhattan & Interborough Rapid Transit Company of New York, the Ontario Power Company and the Niagara, Lockport & Ontario Power Company of Buffalo. He has been active in engineering, safety and rural lines committee work of the Pennsylvania Electric Association, is a member of the American Institute of Electrical Engineers and the National Electric Light Association. Mr. Vin-

cent's new work will consist of personally directing the activities of field engineers who work with the operating companies on insulator and general construction problems.

Arthur H. Cannon, formerly chief engineer of the Fall River (Mass.) Electric Light Company, has been transferred to the Montaup Company of Somerset, Mass., where he will assume the duties of assistant superintendent of plant.

Willis T. Batcheller has joined O. H. Kneen in the formation of a new firm of consulting engineers, Batcheller & Kneen, Inc., with offices in Seattle, Wash. Mr. Batcheller has been active in the power industry for the last fifteen years, having specialized in hydro-electric development, steam power generation, transmission and application.

H. L. Sanborn, hydraulic and electrical engineer of the Abitibi Power & Paper Company, Ltd., has been appointed manager of the Abitibi Electrical Development Company, just organized to take over the Island Falls (Ontario) power plant of the Abitibi Paper Company.

P. Arnold Anderson has resigned from the position of assistant manager of the Great Western Power Company and has accepted the appointment of manager of the business development department of the Oakland Bank. For the past six years Mr. Anderson has been associated with the Great Western Power Company in the capacity of industrial engineer, serving for the last two years as assistant manager. During this period he has been closely connected with the industrial development of Oakland.

A. H. Stack has been appointed manager of the northern division of the Adirondack Power & Light Corporation. Following graduation from Cornell University in 1914 he took the Denver Gas & Electric Company's two-year training course in public utility operation, subsequently becoming superintendent of the Ohio Service Company at Coshocton. For five years prior to joining the Adirondack forces, Mr. Stack held the position of general manager of the Warren Electric Light & Power Company of Warren, Pa. In addition to his duties as northern division manager, Mr. Stack has also been assigned the duties of manager of the Glens Falls district.

W. A. Shoudy has been appointed production engineer for the General Engineering & Management Corporation. Mr. Shoudy's experience covers twenty-five years of steam power engineering, both in the public utility field and with some of the larger industries. During the past fifteen years he has been intimately identified with the central station industry, both as a designer and as an operator. He was formerly assistant mechanical engineer of the J. G. White Engineering Corporation and more recently served as power engineer for the American Sugar Refining Company. In 1921 he was given charge of the operation of the New Amsterdam steam station of the Adirondack Power & Light Company. A graduate of Stevens Institute of Technology, Mr. Shoudy has always been interested in education. For some years he served on the faculty of Stevens and two years ago he took charge of the instruction of steam power at Columbia University, where he is now associate in mechanical engineering, at the same time retaining his connection with the Adirondack system as advisory engineer.

Dr. B. B. Brackett, head of the electrical engineering department at the University of South Dakota, Vermilion, was elected chairman of the new state board of engineering and architectural examiners at its first meeting, held recently at Pierre. The new state board, created by an act of the last state Legislature, will have charge of the registration of architects, engineers and land surveyors.

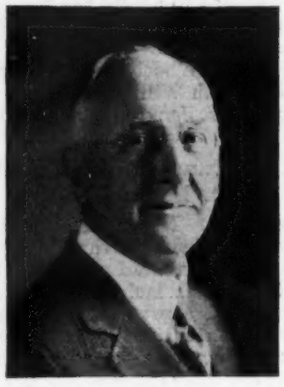
H. A. Rands, consulting engineer of Portland, Ore., left July 15 for Nome, Alaska, to accept an engineering position with Hammon Consolidated Gold Fields. Mr. Rands has been prominently identified with hydro-electric development in the Northwest, having recently been consulting engineer on the Oak Grove project of the Portland Electric Power Company.

C. J. Yorath, formerly city commissioner of Edmonton, Alberta, who was recently elected president and general manager of Northwestern Utilities, Ltd., Edmonton, Alberta, has been elected president and managing director of the Canadian Western Natural Gas, Light & Power Company, Calgary, Alberta. Mr. Yorath will divide his time between Calgary and Alberta.

Obituary

T. E. Bibbins

Tracy E. Bibbins, president of the Pacific States Electric Company, San Francisco, died at his home in Berkeley, Cal., July 3 of heart failure. The death of Mr. Bibbins marks the passing of one of the pioneers and best known



T. E. BIBBINS

men in the electrical industry of the Pacific Coast.

Mr. Bibbins began his career in the industry in the year 1889, when he helped construct the first electric street railway in Oregon. Later he entered the employ of the Edison Electric Manufacturing Company, which shortly became the Edison General Electric Company and subsequently the present General Electric Company. In 1895 he was transferred to the San Francisco office of the General Electric Company and rose through successive positions to that of local manager, which he attained in 1912. Although Mr. Bibbins was instrumental in the formation of the Pacific States Electric Company and in the development of that company's jobbing business in all principal cities of the Pacific Coast, he did not join its ranks until 1916, when he became its president. Mr. Bibbins has been an active worker in all electrical organizations for many years on the Pacific Coast. He was in his sixtieth year.

Jean Canivet, resident representative of the Compagnie Française Thomson-Houston, with offices in the International General Electric Company at Schenectady, died July 10, the victim of a swimming accident at Glenotia Park, near that city. Mr. Canivet, who was born in France, had been resident representative of the French company at Schenectady since 1912.

Cecil W. King died May 24, in his thirtieth year, from the effects of gassing and shell shock sustained during the World War. Mr. King had been identified with the electrical industry in New York since 1912, when he entered the employ of the Western Electric Company. Subsequently he was affiliated with the Richmond Light & Railroad Company, Livingston, Staten Island; the New York Edison Company, the general electric maintenance department of the Interborough Rapid Transit Company and the Otis Elevator Company at Yonkers. His latest connection was with the Electric Bond & Share Company, New York, in the capacity of electrical designer.

Leonardo de Albuquerque Cavalcanti was recently killed instantly when he came in contact with a high-voltage line while supervising the electrification of a section of the Paulista Railway, Brazil. Mr. Cavalcanti was a native Brazilian. Coming to the United States to take a graduate course in the School of Electrical Engineering at Princeton University, he later joined the Western Electric Company at Cicero, Ill., and for a year before returning to his own country he was with the Westinghouse Electric & Manufacturing Company. Mr. Cavalcanti became an associate of the American Institute of Electrical Engineers in 1916. He was in his thirty-third year.

Harold H. Clark, chief engineer of the Wico Electric Company of West Springfield, Mass., and for many years chief electrical engineer of the United States Bureau of Mines at Pittsburgh, died at Ellsworth, Me., July 8 after a long illness. Mr. Clark was a graduate of Worcester Polytechnic Institute and began his career with the General Electric Company at Schenectady, N. Y. He was fifty-four years of age.

Recent Court Decisions

Company Not Bound by Assurances of Safety of Wiring Given by Workmen.—In the case of Kuhlman vs. Water, Light & Transit Company the Supreme Court of Missouri said that as regards the repair of appliances owned by customers a power company was only required to furnish men with skill enough to make the necessary repairs and not men with the requisite knowledge to pass upon the safety of an installation. The company had been requested by the plaintiff to send men to repair an electric flatiron which had given her a slight shock. They made repairs by placing a ground wire on the house lead and, testing the flatiron, told the plaintiff it was safe to use it. A few minutes later the plaintiff was first shocked and then severely burned either by the iron or because she went into the yard and clutched the ground wire, fearing, as she testified, that the premises would catch fire. The Supreme Court reversed the decision of the lower court, awarding damages and remanded the case, holding that general charges of negligence against the company for allowing excessive voltage to pass over the house wires could not be made the foundation of damages in an action based on a specific case and also that the workmen's assertions were not binding on the company. (271 S.W. 788.)*

Reduction in Capacity of Engine for Municipal Power Plant Held Not a Departure from the General Plan.—The Supreme Court of Arkansas in Arkansas-Missouri Power Company vs. Light & Power Improvement District No. 1 of Piggott held that the engineers and commissioners of an improvement district could reduce the size of the engine for a contemplated light and power plant without departing from the general plan under which the project was authorized. The power company, as an owner of real estate in the district, brought suit claiming that the expense of the project would be more than the legal limit for such expense and that the commissioner and engineers were not authorized to reduce the size of the engine to be installed. The court held, however, that the evidence failed to show that the expense would exceed the legal limit and that the commissioners were within their rights in reducing the engine capacity if they thought it practical to do so and still maintain adequate service. (271 S. W. 947.)*

Presence of Dangerous Amount of Electricity Can Be Determined Only by Circumstantial Evidence.—In Tucson Gas, Electric Light & Power Company vs. Doe the Supreme Court of Arizona said: "It must be remembered that it is practically impossible to prove the presence of an electric current except by circumstantial evidence. It cannot be directly apprehended by any of the five senses. We determine its presence only by the effects which that presence produces." The power company was sued for the death of a boy killed by contact with electrically operated instruments in a photograph gallery where he worked. The instruments were designed for operation on secondary voltage, but it was contended that, through the power company's negligence, the primary wires became entangled in the secondary wires and that the primary voltage impressed on the instruments was the cause of the boy's death. The court held that the company was negligent in allowing primary voltage to enter equipment designed for secondary voltages, and that broken lamp globes and glasses were admissible as evidence that primary voltage had been impressed on the circuit in the photograph gallery. (236 Pac. 464.)*

Outside Workman Declared to Be in Employ of Power Company Since He Took Orders from It.—In the case of Oklahoma General Power Company vs. the State Industrial Commission the Supreme Court of Oklahoma ruled that a man who had been employed by another company as a truck driver but had been assigned to special work for the power company and took orders from its officials became by that act an employee of the power company. The Industrial Commission had awarded compensation to a truck driver who was injured while returning from a construction job of the power company to which he had been assigned by his original employers, who furnished trucks and drivers to be placed under the power company's direction. Disputing responsibility for the injury, the power company in an appeal from the commission's award contended that the driver was, at any rate, no longer in its service, since he was returning with the truck from the job, but the court ruled that in the absence of evidence of wilful neglect or intoxication on the part of the driver the power company was still responsible. (235 Pac. 1095.)*

Notice of Exercise of Option to Measure Consumer's Maximum Demand Held Unnecessary.—The case of the Missouri Gas & Electric Company vs. Trimble was a suit carried to the Supreme Court of Missouri by the service company in an effort to squash the findings of the Kansas City Court of Appeals in the original case of the company against the Rea & Page Milling Company. In 1915 the company had entered into a contract with the mill to charge it for service on the basis of maximum demand. For three years the maximum demand on which the charge was based remained the same, and then the company claimed that it measured the maximum demand and, finding it more, submitted a larger bill. The court upheld the company's claim that it could measure a consumer's maximum demand without previous notice as long as it measured it and charged for service in accordance with the method approved and the rate schedule filed with the Public Service Commission. (271 S. W. 43.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Rates and Service Inseparably Associated.—The Missouri Public Service Commission recently stated, in hearing a complaint directed against the electric rates of the Laclede Gas Light Company, that the evidence given in the case, which largely concerned the poor quality of service, could be received in a rate case. The commission said: "Although service is not specifically mentioned in the complaint herein, rates and service are inseparably associated and must be considered concurrently. Rates are fixed on the basis, among other things, of reasonably satisfactory service. In other words, whenever the question of reasonable rates is at issue, the necessity for consideration of service automatically appears."

Old Rates Cannot Be Continued in New Contract Without Investigation.—The Pennsylvania Public Service Commission disapproved a contract between the New Castle Electric Company and the city of New Castle which provided that the company should furnish street lighting and domestic and commercial electricity until 1930 according to the rates and tariffs at present filed with and approved by the Public Service Commission. The commission held that it could not approve the rates in effect as just and equitable without due process of law, which would require either the filing of a complaint before the commission or an investigation instituted by the commission to determine the fairness of the rates.

Invasion of Territory Not Shown When Coal Mine Rearranges Lines to Take Energy from One Company.—The Illinois Commerce Commission held, in Homer Electric Light & Power Company vs. Illinois Power & Light Corporation, that invasion of territory was not shown that a coal mining company which had previously received service from one power company purchases another adjacent mine, served by another utility, and rearranges its wires so that both mines are served by the first power company. The commission said in part: "While the complaining company has undoubtedly lost a consumer, it cannot be maintained that the respondent company has invaded the territory of the complainant. The respondent already delivers electrical energy to the private wires of the coal company, and has an undoubted right so to do. While an electric utility company is engaged in rendering service, rather than in selling a commodity, and may, therefore, exercise reasonable control over the use of the energy supplied by it, there appears to be no reason, identified with public interest, in the instant case to require that the use of the energy of the Illinois Traction, Inc., be permitted on one portion of the coal company's property and forbidden on another portion thereof."

Manufacturing and Markets

Substandard Material

Eliminate Competition by Checking It at Source—Large Volume Used in Maintenance Work Beyond Reach of Code

BY A SUPPLY MANUFACTURER

TO MEET the present unsatisfactory price situation in the wiring-material field may require the concerted action of all manufacturers to curb the production and sale of substandard material. It is recognized by most manufacturers that there are too many producers in the field at the present time to permit any one of them to run at an economical capacity. At the same time it is apparent to anyone that much substandard wiring material is being manufactured and sold. A short trip to the nearest drug or department store will convince the skeptic, and yet the sale of substandard material used in electrical maintenance work is not confined to the non-electrical stores.

With a potential over-production to face, manufacturers should be glad to co-operate to protect their business from the unfair competition of this inferior material, and they should be glad and willing to protect the public from the hazard and false economy of using substandard material. If there must be a curtailment of production in the field of electric wiring supplies, is it not right that the curtailment should come first in the production of those materials that are not up to accepted standards?

CONTROL MUST BE AT SOURCE

The present method of controlling the use of substandard material is confined principally to the inspection of finished work, the inspector having the power to reject any work in which unapproved or substandard material has been used. For the great majority of installations there is no reinspection made and no control is exercised over materials used in maintenance. It is very questionable whether such reinspection could justify its expense because it is hard to believe that it would effectually check the continued use of unapproved materials. It is extremely difficult to make a thorough inspection of a completed job. The only point at which economical inspection and effective control can be exercised is at the source of supply. So long as defective materials are manufactured in large volume, defective material will be sold and used. The surest, safest and best method of meeting the problem of substandard material is to prevent its manufacture and sale.

A METHOD OF CHECKING QUALITY

Compulsory approval of all materials manufactured is the most promising way to a better condition. The submission at regular intervals of products manufactured for their inspection, test and approval by a disinterested non-commercial organization would seem the most feasible machinery to use. The location, organization and details of financial support are features that are possible of fair solution. The first and all-important step is the agreement among manufacturers themselves to support a centralized organization whose chief object shall be the protection of the manufacturers from the competition of substandard material and the protection of the public from the hazards and waste in the use of such material. If the tree must be trimmed let us start by cutting away the defective limbs.

Trade Acceptance Experience

Chicago Members of Electrical Credit Association Indicate Advantages and Limitations of Trade Acceptance as Discovered in Business Transactions

AT A RECENT meeting of the Chicago division of the National Electrical Credit Association the practices of members in the use of trade acceptances were discussed in the light of actual experience. Reports of these member companies, all of which have offices or headquarters in Chicago, are of interest to manufacturers, jobbers and dealers, as indicating the possibilities and limitations of the trade acceptance to manufacturing and distributing agencies in the electrical industry.

It was reported at the meeting that much confusion and dissatisfaction resulted wherever companies permitted the use of trade acceptances for anything other than current accounts. Trade acceptances, it was pointed out, should not be used to renew other acceptances nor to serve as payment for overdue accounts. The trade acceptance is "an acknowledgment of debt for goods sold at a specific price and according to specific terms." The acceptance must include only specific charges for goods sold.

ADVANTAGES OVER OPEN ACCOUNT

While it was pointed out that trade acceptance will not convert a poor risk into a good risk, except so far as there is a greater moral obligation involved in the case of trade acceptance than in the open account, it was the opinion of the majority of companies reporting that the trade acceptance had specific advantages over the open account in that it might be expected to secure payment within forty-five to sixty days, whereas ordinary open accounts were frequently not paid within that period. An exception to this was cited by one manufacturer who, during the busy season, was able to force more prompt payment of open accounts through the withholding of shipments than through trade acceptances. This company did not discount its acceptances at the bank but preferred to get its money immediately from the purchaser, taking advantage of the demand for goods at certain seasons of the year.

An important advantage of the trade acceptance to companies engaged in a business with a seasonal demand was pointed out by one manufacturer whose production and shipments commence in July, although the final sale of the goods at retail does not occur until December. Through the use of trade acceptances this company is able to start shipments six months in advance of the time for the sale of the goods and is able to get its money out of its goods by discounting the acceptances, and thus reduce the working capital that would otherwise be necessary.

TIME AND PLACE OF PAYMENT

One company reported that some buyers prefer to have the acceptances payable at their offices rather than at a bank. While such a practice is entirely permissible, it was pointed out that there was generally a greater moral assurance that payment would be made if the place of payment was at a bank than at the purchaser's office, and further, the seller was relieved of the necessity of notifying the customer when payment of the acceptance became due. There was considerable difference of experience as to the practice of banks in the payment of acceptances running longer than ninety days or 120 days, most banks refusing to make payment until within ninety days of the maturity of the acceptance.

Attention was called to the importance of having the trade acceptance signed by the same parties whose signatures were necessary for payment by the banks of checks and notes of the purchaser. Cases of this sort arise frequently in transactions with partnerships where checks and notes are signed by both partners while trade acceptances are sometimes signed by only one member of the firm. In such cases the bank generally refuses payment without specific authorization.

STATUS OF ACCEPTANCE AND NOTE

An important distinction between trade acceptances and notes was made in the statement that whereas notes are generally accepted as "payment" for an account, trade acceptances are to be understood as "acknowledgment of indebtedness for specific goods at a

specific price." The importance of this distinction is brought out in consideration of a mechanic's lien, wherein legal action must be taken on a note that has been given in payment of an account, as most state courts hold that acceptance of a note in payment of an account waives the right to a lien. Whether such a situation exists in the case of trade acceptances depends largely upon the wording of the statute of the various states pertaining to a mechanic's lien and the statute pertaining to trade acceptances. While associations and bodies having to do with the dissemination of information on trade acceptance practice advise that the use of a trade acceptance does not waive the right to a mechanic's lien, in the majority of the states opinion was expressed by members of the association that the specific wording of the statute of the various states was the determining factor. It was, however, found that the Federal Reserve Bank did not consider the use of the trade acceptance as a waiver of a mechanic's lien.

Other Advantages and Limitations

Inclosing the trade acceptance with the invoice to which it referred was cited as a means of preventing consideration, by the purchaser, of the trade acceptance as payment for an overdue account. The practice of many companies is to return any trade acceptance offered in payment of an overdue account. The use of trade acceptances was reported as satisfactory in the case of a manufacturer selling to a dealer who in turn sold on time payment, as then the trade acceptance is really performing one of its primary functions—that of financing time-payment sales.

Limitations of the trade acceptance were stated by one company as being, principally, the confusion that was liable to result from handling both notes and trade acceptances, the increased accounting necessary, and the inability, as a general practice, of collecting interest on long payments. There was, however, a general agreement that it was entirely practicable to write on the face of the acceptance the amount of interest that was to be charged because of the extension of time payment.

Need for Better Understanding

Although much interest in the trade acceptance was shown by all manufacturers represented and while most member companies of the Chicago division use it to a greater or lesser extent, the average report showed that the trade acceptance was being used with less than 5 per cent of the "accounts receivable." One company reported the use of trade acceptances to the extent of 10 per cent, while several companies reported less than 1 per cent use. The opinion was expressed that more general and accurate information on the part of both manufacturers and distributors as to the advantages and limitations of the trade acceptance would result in its more general use, with the advantages outweighing the disadvantages and with the assurance of a certain amount of stimulation to trade.

Trade Situation Favorable

Hoover Points to Many Factors in 1924 that Justify Optimistic Attitude and Leave No Cause for Complaint

IN REVIEWING the economic conditions in the United States during the year 1924, Secretary Hoover, in the foreword of the Commerce Year Book of the Department of Commerce, stated that the general situation was favorable, and the American people have little right to complain about our economic situation. "Even agriculture," says Mr. Hoover, "has shown some partial recovery from its three years of extreme difficulty. Our industrial production was only about 5 per cent less than in 1923, which was the record year in the history of the nation, but was 13 per cent greater than in 1919."

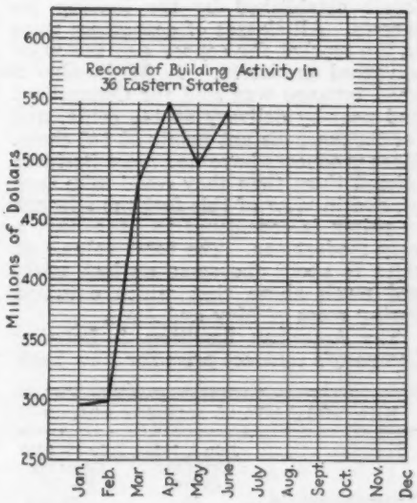
Mr. Hoover pointed out that there was practically no unemployment in a distressing sense, that transportation showed an increasing efficiency, and by its very efficiency has resulted in a mild revolution in the distribution of goods, that building and other construction in 1924 was the largest in our history, and that the shipping industry showed some improvement in 1924, although it has not yet reached a basis of stability. It was also stated in the review that our foreign trade was in a much more favorable condition than in 1923, and conditions in Europe were more stable.

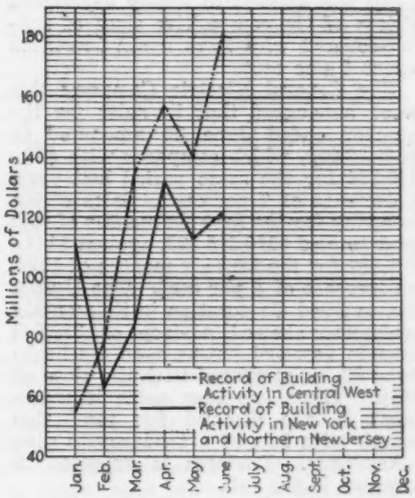
"The publication by the Department of Commerce of the results of the exhaustive manufacturers' census taken for the year 1923 brings out vividly the rapid progress in industrial efficiency and in elimination of economic

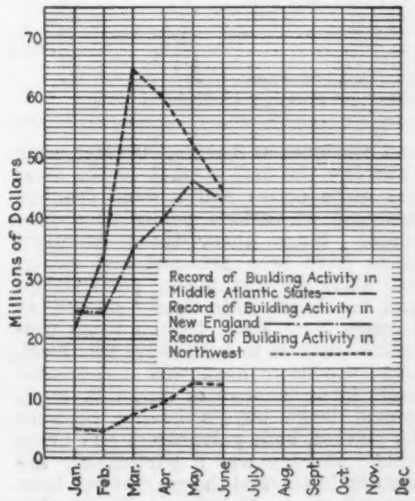
Building Contracts in Thirty-six Eastern States by Territorial Divisions

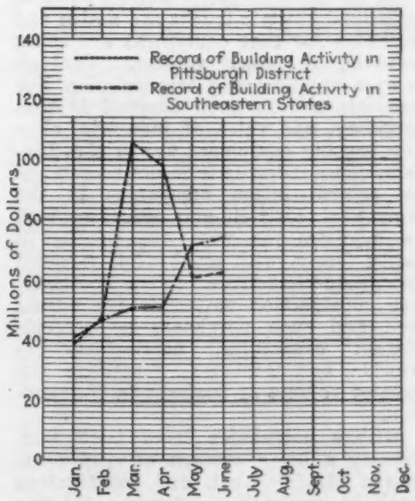
The Contracts in These States Include About Seven-eighths of the Total Construction Volume of the Country

(Compiled from the F. W. Dodge Corporation Building Reports)









The Middle Atlantic States include eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia and Virginia.

The Southeastern States include North and South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Arkansas and Louisiana.

The Pittsburgh District includes western Pennsylvania, West Virginia, Ohio and Kentucky.

The Central West includes Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri, Kansas, Oklahoma and Nebraska.

The Northwest includes Minnesota, the Dakotas and northern Michigan.

waste during recent years," says Mr. Hoover. "The figures for 1923, when reduced to a quantitative basis (in order to avoid the effect of decreased purchasing power of the dollar), show that our manufacturing output has increased by fully 60 per cent over that of 1914. The figures also show a very substantial gain over the year 1919.

"Against this large increase in products the number of wage earners increased by only 25 per cent as between 1914 and 1923, and it is interesting to note that the horsepower used increased 50 per cent in the same period. Wages for 1923 and 1924 were generally maintained at about 100 per cent higher than in 1913, and with the cost of living on a basis of about 70 per cent over the pre-war level our labor is receiving a large share of the result of this increased efficiency in the highest real wages of our history. The higher real wage has been expressed both in advancing standards of living and in greater savings on the part of the masses of the population."

Business Conditions

SALES of electrical equipment are in steady volume, are satisfactory as compared with a year ago, and the outlook is better for the ensuing months. Central-station companies are purchasing distribution equipment and supplies and are actively proceeding with construction work. An order for substation apparatus that is expected to be placed shortly by one utility company will amount to nearly $1,000,000. Prices of the competitive sizes of rubber-covered wire have again increased about 5 per cent.

The General Electric Company this week announced that its sales for the quarter ended June 30 amounted to $66,468,992, which compares with $71,219,984 for the same period last year, a decrease of 7 per cent. Sales of the company for the first six months of this year totaled $150,315,228, against $144,707,887 for the first six months of 1924, an increase of 4 per cent. The United States Steel Corporation in its monthly statement showed a drop of 339,342 tons in forward business on its books June 30, as compared with the close of May. There has been some improvement in the demand for steel this month with less of a tendency to give concessions. Business is expected to increase in the fall.

In the New England district sales of industrial electric trucks are active and inquiries for that equipment are being received in good volume. Central-station supplies and transmission line products are in good demand in that territory, and sales of industrial electric heating equipment are brisk. Distribution apparatus is in active demand by central-station companies in the New York district, and orders as well as inquiries for wire are coming in fairly freely, with much of it received from industrial firms. In the Southeast line construction materials are selling well and such purchases by central-station companies, particularly in Florida and Alabama, constitute the greater volume of business in that section.

Utility companies have been purchasing a large amount of equipment in the Middle West, and construction work is proceeding actively. On the Pacific Coast sales are improving, with excellent prospects for the remainder of the year. The demand for electric ranges continues to be active in that territory.

Non-Ferrous Metal Market Active —Prices Again Advance

COPPER has again been in active demand at advancing prices, zinc and tin have sold well at slightly higher levels and lead has also been in good demand though the supply has become a little freer and it has not been so easy to obtain premiums above the levels established by the leading interests. All classes of consumers were in the market for copper and the price advanced gradually. On Wednesday a good tonnage was sold for Connecticut and near-by delivery at 14¼ cents, and for the more distant points at 14⅜ cents. Most producers have had more business offered them than they could take care of, and in view of this fact the advance in prices is considered to have been a very modest one. The total volume of sales is about the same as last week, and much above that which obtained during most of May and June.

The American Smelting & Refining Company's contract price for New York lead continues at 8 cents. On last week Thursday the lead market in the East was quite active and a good tonnage was sold at various points at a premium. Since then, these premium prices have been obtained less easily, and early in this week, particularly, lead has been quite freely offered at 8 cents, New York, though some producers continue to hold above this level. Some producers have sold a comparatively large tonnage of zinc this week, several large buyers having been in the market, both galvanizers and brass mills. Monday was a particularly active day in tin, and the market has been firm all week, though on Wednesday a slight recession in price to 58 cents occurred. The premium on spot metal has virtually disappeared, but shipments continue slightly below the prices asked for prompt.

NEW YORK METAL MARKET PRICES

	July 8, 1925 Cents per Pound	July 15, 1925 Cents per Pound
Copper, electrolytic	14	14.27½
Lead, Am. S. & R. price	8	8
Antimony	19	19½
Nickel, ingot	34	34
Zinc, spot	7½	7.52½
Tin, Straits	57½	58
Aluminum, 99 per cent	28	28

Base copper price July 15, 1925, 16½ cents.

Industrial Electric Truck Sales Active in New England District

INQUIRIES for industrial electric trucks are being received in good volume in the New England district and one manufacturer reports several sales during the past week for plants in Maine, Connecticut and western Massachusetts. This positive trend in the buying of this product reflects a real optimism in industrial conditions for the coming fall and presages an encouraging activity in mill and factory centers throughout this district. A good volume of sales of diversified electrical products continues with the movement in small motors showing no slackening of the upward trend which has marked the past few weeks. Production of small motors by one company is announced as about 65 per cent capacity and another manufacturer records his present output at about two-thirds the normal production.

Central-station supplies and transmission-line products continue to be in good demand with wire, poles and fiber conduit most active. The industrial electric heating business is brisk. One manufacturer reports several sales of small units with other very encouraging prospects in view. Another reports a marked interest in electric heating throughout the industrial centers of Connecticut and Rhode Island. Small power units for farm and household use are quite active in northern Vermont and New Hampshire and domestic appliances show a surprisingly steady trend. One group consisting of central-station companies reports receipts in excess of 35 per cent for the week ended July 4, 1925, as compared with the corresponding week in 1924. Another jobber reports the sales of vacuum cleaners to be well over the volume of last year for the week ended July 11, with business coming through lighting companies and department stores in good measure. Indications of an awakening radio market are reported in the increasing number of inquiries concerning stock and delivery of loud speakers, batteries and general supplies.

Distribution Apparatus in Active Demand in New York District

SALES of supplies and distribution apparatus to central-station companies continue in good volume. One order just placed for equipment amounts to approximately $100,000. Negotiations are now under way for such equipment for one company that will total nearly $1,000,000. With the exception of one or two scattered cases there have been practically no sales of generating equipment this year. A number of orders are being placed for switching equipment but they are individually small. Several manufacturers of such apparatus report sales in June as the best of the year. Indications point to improved buying by central-station companies in the fall.

A manufacturer of wire states that orders as well as inquiries have been coming in fairly freely, and purchasing by industrial companies is good. Prices on the competitive sizes of rubber-

covered wire were again increased this week about 5 per cent, but no real immediate demand has yet been noticeable. Sales of control equipment by one company are said to be better for the first half of this year than they were for the same period last year. A steady expansion is reported by this company and the outlook for it is good. An electric truck manufacturer says that his sales for the first six months of 1925 are ahead of those for the same period last year and he believes that by aggressive effort this lead can be maintained. Jobbers state that business is slow but is better than for the same period last year.

Line-Construction Materials in Demand in Southeast

CENTRAL-STATION purchases constitute the greater volume of business in the Southeast. An order for $30,000 worth of ½-in. guy strand and another order for carrier-current equipment amounting to approximately $40,000 were placed. Line-construction materials are in very active demand, particularly in Florida and Alabama, and one order was received by an Atlanta jobber this week for twenty carloads of creosoted pine poles. The construction program under way in this section, particularly in Florida and Alabama, has served to sustain the volume of business. Most jobbers report their business for the first six months of this year in excess of the same period of 1924.

Some activity is being displayed by the steam railways, several of the larger systems being engaged in the installation of block-signal and train-dispatching equipment. One order for this equipment amounting to about $40,000 was received by an Atlanta jobber in the past few days. A great deal of interest is being displayed by municipalities and private real estate concerns in the installation of white-way systems, and several orders for such material were received last week, two of these orders amounting to $10,000. Inquiries on hand for white-way and highway lighting fixtures are satisfactory. Commercial lighting fixtures are in good demand and fan sales are brisk. Sales of appliances to central-station companies are good but dealer purchases are slow. In Georgia some increased activity among small contractors is to be noted, but except in isolated cases the larger contractors seem to have decreased their purchases.

Sales Improving on Pacific Coast —Demand for Ranges Active

BUSINESS on the Pacific Coast is improving in all branches, with excellent prospects for the remainder of the year. There have been few spectacular orders placed during the past week, but the most encouraging feature is that jobbers report that dealers are again buying staple lines in packages instead of hand-to-mouth quantities. In the Seattle district inquiries for wiring supplies and certain heavy apparatus have shown a decided quickening. Building construction has been quite active and June permits show an increase over those issued during the same month last year.

Power company buying was largely for maintenance material but several carload orders for electric ranges are in preparation. Export business has been particularly varied, including telephone equipment for the Philippine Islands, railroad signaling equipment and wiring supplies for Mexico, besides fuses and insulating supplies for Alaskan mines. Central American business in also good. Railroad buying has included much special cord, magnet wire and lead-covered cable for the Oakland shops. From the Oakland district also is reported a contractor's order for a carload of rigid iron conduit and a municipal order for three carloads of 3-in. fiber conduit. Improving contracting business is reducing coast stocks, although some schedule material items have been high. Prices are steadier with an upward tendency and the general advance predicted for spring may be fulfilled in the fall. Twenty per cent of the logging camps and 90 per cent of the fir sawmills have resumed operations following the midsummer shutdown. The outlook for fall business, when the lumber market will have been stabilized and crops harvested, is generally conceded to be good.

Utility Companies Purchasing Material in Middle West

THE various utility companies in the Middle West are buying considerable quantities of equipment, such as oil circuit breakers and distribution apparatus, and construction work is proceeding actively. There has been a good demand for overhead materials and distribution transformers, with a fair demand for motors. Industrial manufacturers are apparently working longer periods, as indicated by the lower number of unemployed. Jobbers report that the volume of business is quite satisfactory. Appliance sales have been good, particularly the sale of irons. Several large orders for irons were received by manufacturers this week, one of which totaled more than $15,000. Fan sales have been good, with a fair demand for radio apparatus. Prices are generally firm, except that the competitive sizes of code wire advanced slightly in price.

Value of Electrical Exports for May, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	May 1924	May 1925
Generators:		
Direct-current:		
Under 500 kw.	$107,395	$63,409
500 kw. and over	66,167	18,468
Alternating-current		
Under 200 kva.	6,319	16,664
2,000 kva. and over	37,252	101,200
Steam-turbine generator sets	2,312	56,210
Accessories and parts for generators	113,427	38,980
Self-contained lighting outfits	100,532	92,000
Batteries:		
Flashlight batteries	98,530	128,374
Other primary batteries	68,333	97,941
Storage batteries	263,670	219,016
Transforming or converting apparatus:		
Power transformers	431,358	173,788
Other transformers	229,098	78,979
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	67,109	34,252
Transmission and distribution apparatus:		
Switchboard panels, except telephones	186,208	156,472
Switches and circuit breakers over 10 amp.	180,039	143,599
Fuses and fuse blocks	30,162	29,407
Watt-hour and other measuring meters	25,498	38,410
Volt, watt and ampere meters and other recording, indicating and testing apparatus	114,014	143,801
Lightning arresters, choke coils, reactors and other protective devices	130,780	37,459
Motors, starters and controllers:		
Motors, under 1 hp.	172,905	182,429
Stationary motors:		
1 to 200 hp.	190,254	178,521
Over 200 hp.	27,704	45,687
Railway motors	144,049	74,226
Electric locomotives:		
Railway	107,132	4,191
Mining and industrial	43,857	39,138
Other motors:		
Starting and controlling equipment for:		
Industrial motors	172,439	135,837
Electric railway and vehicle motors	3,815	10,552
Accessories and parts for motors	208,503	174,097
Electrical appliances:		
Electric fans	122,824	68,832
Electric lamps:		
Metal-filament	97,226	112,190
Other electric lamps	28,375	20,276
Flashlights	76,348	137,628
Searchlights and projectors	22,080	26,881
Motor-driven household devices	78,795	103,625
Domestic heating and cooking devices	95,801	133,448
Industrial electric furnaces and ovens	34,171	4,798
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	73,117	90,021
Signal and communication devices:		
Radio apparatus	295,677	677,710
Telegraph apparatus	46,328	22,649
Telephone apparatus:		
Magneto telephones	10,077	11,869
Other telephones	38,853	40,841
Telephone switchboards	77,660	223,967
Other telephone equipment	204,539	185,171
Railway signals, switches and attachments	118,551	109,001
Bell, buzzers, annunciators and alarms	10,469	17,805
Other electric apparatus:		
Spark plugs, magnetos, and other ignition apparatus	163,500	334,540
Insulating material	122,487	119,861
Metal conduit, outlet and switchboxes	70,894	86,845
Sockets, receptacles and lighting switches	125,710	124,229
Electric lighting fixtures, interior and street	72,165	110,477
Other wiring supplies and line material	107,118	96,891
Other electrical apparatus	668,663	546,665
Globes and shades for lighting fixtures	44,661	41,596
Electrical glassware, except for lighting	17,134	37,503
Electrical porcelain	134,856	*
Electrical porcelain for less than 6,600 volts	*	45,281
For 6,600 volts and over	*	79,578
Electrical carbons, carbon brushes and electrodes	261,197	†
Electrodes for electric furnaces	*	71,986
Other carbon products	*	265,360
Insulated wire and cable (iron and steel)	32,497	19,846
Other manufactures of aluminum	57,570	71,465
Copper, bare wire	99,513	285,092
Copper, insulated wires and cables	332,825	361,769
Total electrical machinery and apparatus and supplies	$7,070,542	$7,198,803

* Not separately stated prior to January 1, 1925.
† Discontinued beginning January 1, 1925.

Activities of the Trade

General Electric Orders for Half Year Show Slight Increase

Gerard Swope, president of the General Electric Company, announces that orders received by the company for the three months ended June 30 amounted to $66,468,992, compared with $71,219,984 for the same period in 1924, a decrease of 7 per cent. For the six months of the present year orders totaled $150,315,228 and compare with $144,707,887 for the first half of 1924, an increase of 4 per cent. Reports from various sources indicate a good outlook for the latter half of 1925.

Fuller-Lehigh Acquires Pulverized Fuel Interests of Bonnot Company

Everything in connection with the pulverized fuel business of the Bonnot Company, Canton, Ohio, has been acquired by the Fuller-Lehigh Company, Fullerton, Pa. Under this arrangement the Fuller-Lehigh Company has secured the exclusive rights to the "Blake Water Tube Bottom" (water screen), "Blake Vertical Firing" and "Sherban" and "Pomeroy Unit-Air-Ball" mills, now known as the "Fuller-Bonnot Unit Ball" mill. Some of the engineering personnel of the Bonnot Company has also been retained by the Fuller company. This, it is said, places the Fuller company in a position to furnish both low-speed and high-speed unit mills for direct firing, as well as for central-station plants, and enables it to offer the necessary patent protection to its customers in so far as engineering design, processes and equipment are concerned.

This agreement was concluded between the two companies in June, and announced in the ELECTRICAL WORLD in the issue of June 27. The company states that since that time it has sold several of the "Fuller-Bonnot Unit Ball Mills" and is also figuring on many other installations of this type, both in this country and Europe.

Westinghouse Electric Company of Japan Organized

Following the organization meeting of the Westinghouse Electric Company of Japan, held on Wednesday at the Westinghouse offices, 150 Broadway, New York, E. D. Kilburn, vice-president of the new company, made the following statement:

"The Westinghouse Electric Company of Japan is a newly-organized subsidiary of the Westinghouse Electric International Company, incorporated under the laws of the state of Delaware with a capital of $1,000,000. The purposes of this company are to distribute Westinghouse products throughout Japan and to arrange for proper service to the many old, as well as the new, users of Westinghouse apparatus in Japan. Adequate stocks will be carried, repair and other service facilities will be provided, and engineering and construction assistance will be supplied to users of the company's products.

"The staff in Japan will be almost entirely Japanese. It was a simple matter to assemble this staff because there are scores of Japanese engineers who have been employed at the Westinghouse company's works at East Pittsburgh and elsewhere. The officers of the new company are:

"Guy E. Tripp, chairman; L. A. Osborne, president; E. D. Kilburn, vice-president, and I. F. Baker is managing director, located at Tokio. The meeting of the directors held Wednesday was to carry out the organization formalities."

The Bryant Electric Company, Bridgeport, Conn., manufacturer of wiring devices, announces the development of a new canopy switch, rated at 3 amp. 125 volts, 1 amp. 250 volts, that will fit into a space with only $\frac{7}{16}$ in. clearance.

The Brammer Washing Machine Company, succesor to the White Lily Manufacturing Company and the H. F. Brammer Manufacturing Company, Davenport, Iowa, announces that it has placed on the market its new washing machine, known as the "White Lily Ace" No. E-40-C. The company states that this new machine is a radical departure from anything previously marketed by either of the two companies which have formed the present combination.

The Ideal Commutator Dresser Company, Sycamore, Ill., has opened a new branch office at 421 Fulton Building, Pittsburgh. The company will carry at this office a stock of Ideal commutator resurfacers and Ideal wire connectors for emergency purposes. R. F. Waldo, for a great many years connected with the New York office, has been appointed district sales engineer.

The Pacific Electric Manufacturing Company, 827 Folsom Street, San Francisco, manufacturer of high-tension equipment, announces the removal of its Los Angeles office to 804 H. W. Hellman Building.

The Cutler-Hammer Manufacturing Company, Milwaukee, announces that it has added to the C-H wiring device line new single and double flush receptacles. The catalog numbers are 7910 for the single receptacle and 7920 for the duplex.

The Sangamo Electric Company, Springfield, Ill., announces that it has developed a new lower-bearing construction for its D-5 direct-current watt-hour meters. This type of construction has been previously used in the company's type N ampere-hour meters.

The Shelton Electric Company, Chicle Building, Long Island City, N. Y., announces that it is placing on the market a slot machine hair drier for use at public bath places, etc.

New Equipment Available

Pole Support

A pole support known as the "Malone," designed to reinforce wood poles that have rotted at the ground line but are otherwise in good condition, has been placed on the market by the Blaw-Knox Company, Pittsburgh. The pole support consists of three galvanized pressed and flanged steel plates adjustable to poles having from 10 in. to 14 in. diameters at the ground line. These plates are clamped around the pole just above the ground line by means of bolts and washers and are anchored to three "Malone" anchors. These anchors are of concrete so that the entire support, being composed of concrete and galvanized steel, makes a permanent and lasting unit.

Giant Dial Indicator

A 60-in. dial power indicator, visible at a distance of 250 ft., has been designed by the Westinghouse Electric & Manufacturing Company. It can be used in boiler rooms for indicating the total load of a power station. In this relay-type indicator the pointer is driven by a small motor, which is energized through the contacts of the measuring element.

The cases are constructed of sheet steel and angle iron riveted together, and are so designed as to be dust-tight, all doors having felt packing. The windows in the cases are of plate glass supported in a cushion mounting. The dials are black with white figures and are illuminated by lamps concealed in the case. Doors in the case permit easy access for replacement of lamps and lubrication of moving parts when required. The case of the indicator is about 72 in. square and 30 in. deep and can be supplied with either a single or double face. The indicator may be furnished with a polyphase wattmeter element to operate from the totalizing current transformers or with a direct-current ammeter element to operate from a remote metering apparatus.

Show-Window Reflectors.—Four new types of show-window reflectors have been placed on the market by the Curtis Lighting, Inc., 1119 West Jackson Boulevard, Chicago. Two of the new reflectors, "Jack" and "Jill," use 150-watt or 100-watt lamps. "Jack" is a high-trim reflector for deep windows. "Jill" is a low-trim reflector that gives a semi-concentrating light. The other two new reflectors, "King" and "Queen," use 200-watt lamps. "King" is a distributing type reflector for use in large deep windows that have a high trim. "Queen" is a semi-concentrating type reflector for use in large shallow windows.

New Trade Literature

CLIPS.—The Mueller Electric Company, 1583 East Thirty-first Street, Cleveland, Ohio, is distributing two leaflets calling attention to its "Universal" battery, test and radio clips.

SAFETY SWITCHES.—"The A B C of Safety Switches" is the title of a booklet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in which it tells what they are, why used and how to apply them. It contains wiring data for squirrel-cage alternating-current motors and the rating of safety switches to be used with auto starters and control apparatus, motor tables, etc.

MOTOR STARTING SWITCH.—Supplement No. 1, issued by the Wadsworth Electric Manufacturing Company, Covington, Ky., covers its new type motor-starting switches. It contains an illustration showing the switch in running position and also a wiring diagram.

PRESERVING BUTT-ROTTED POLES.—"Add Years of Life to Busy Poles Now Butt-rotted but Otherwise O. K." is the title of a booklet issued by the Spokane Concrete Pipe Company, P. O. Box No. 1033, Spokane, Wash., in which it describes the "Harding Process" of pole concreting for preserving butt-rotted poles. It contains illustrations showing the five steps in the tested "Harding Process" for reinforcing poles, and a photographic and engineering record of a test for the purpose of determining the strength of "Harding Process" reinforcements.

STOKERS—Bulletin No. 90, issued by the Riley Stoker Corporation, 9 Neponset Street, Worcester, Mass., describes the Jones "Side-Dump" stoker, which is designed to meet requirements of plants where steam is used for power or heating, or both. This stoker is adapted to every type of boiler, in sizes from 50 hp. to about 300 hp.

BAKELITE.—"Reducing Costs—Improving Quality Through Bakelite" is the title of an eight-page folder issued by the Bakelite Corporation, 247 Park Avenue, New York City, in which it calls attention to some of the many uses of Bakelite.

POTENTIOMETER PYROMETERS.—The Leeds & Northrup Company, 4,901 Stenton Avenue, Philadelphia, has issued a new edition of catalog No. 87, covering its various types of potentiometer pyrometers. This is a revision of the 1924 edition.

SCREW COVER JUNCTION CONDULETS.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 2,076 and folder No. 27, covering its various types of screw cover junction condulets.

TRANSFORMERS.—Bulletin No. 2,046 issued by the Pittsburgh Transformer Company, Pittsburgh, Pa., describes and illustrates the Pittsburgh film-type radiator for self-cooled transformers. An illustration showing an installation of three 5,000-kva., 22,000-volt polyphase transformers, self-cooled, equipped with Pittsburgh film-type radiators is included.

HUMIDIFIER.—The Midwest Air Filters, Inc., 100 East Forty-fifth Street, New York City, is distributing a leaflet describing the Midwest automatically controlled humidifier. It contains an illustration showing the humidifier and a drawing of a typical installation layout.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Medan, Sumatra (No. 15,813), of radio sets and parts.

Purchase is desired in Antung, China (No. 15,814), of telephone supplies, and iron, copper and insulated wire.

Purchase is desired in Antwerp, Belgium (No. 15,822), of roller for tennis court, electric or oil motor operated.

TRANSFORMERS AND SPARES FOR MORWELL POWER SCHEME, AUSTRALIA.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Sept. 14 for 3,000-kva. transformers and spares. Specifications are on file at the New York and Chicago district offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and can be consulted by asking for the Morwell Specifications No. 25/30.

PROPOSED ELECTRIC PLANT IN COLUMBIA.—The municipality of Ibague, Columbia, according to *Commerce Reports*, is planning to install an electric light plant.

EXTENSIONS PROPOSED TO ELECTRIC PLANT IN SEVILLE, SPAIN.—Plans are under consideration by the Compania Sevillana de Electricidad, Seville, Spain, according to *Commerce Reports*, for extensions to its electric plant, involving the purchase of considerable electrical machinery. The cost is estimated at 10,000,000 pesetas.

New Incorporations

THE EAST TEXAS LIGHT & WATER COMPANY, Jasper, Tex., has been incorporated with a capital stock of $15,000 to build an electric light and waterworks plant. M. L. Howard, San Antonio, is interested in the company.

THE TALCOTT (W. VA.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $2,000 by J. O. Clark, G. W. Carter, A. L. Aedes, P. A. Ford, and A. G. Burr, all of Talcott.

THE HEMRICK LIGHT & POWER COMPANY, R. F. D. No. 3, Shelby, N. C., has been incorporated with a capital stock of $10,000 by J. C. Hemrick and W. W. Jones.

THE BEAVER LIGHT & POWER COMPANY, Raleigh, W. Va., has been incorporated by R. L. Burmeister and Clifford Mueller.

THE LOUISA COUNTY LIGHT & POWER COMPANY, Mineral, Va., has been organized to supply electricity in Mineral and Louisa, Va. W. Washabaugh is president.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FITCHBURG, MASS.—The Fitchburg Paper Company contemplates extensions and improvements in its power house including the installation of coal pulverizing equipment, etc.

LYNN, MASS.—Bids will be received addressed to the Commission of Ways and Drainage of the City of Lynn, at the offices of the Purchasing Agent and City Engineer, City Hall, until Aug. 18 for sewage pumping equipment, consisting of furnishing and installing two 10,500 gallons per minute and two 21,000 gallons per minute sewage pumping units, complete with all auxiliaries at the city's proposed pumping station located on its property adjacent to that of the Lynn Gas & Electric Company.

WINCHENDON, MASS.—The Mason & Parker Manufacturing Company contemplates installing a 100-kva. generator, etc., at its hydroelectric power station.

MERIDEN, CONN.—The City Council has awarded a contract to the Meriden Electric Light Company for street-lighting for a period of 3 years. The contract provides for improvements in the present system.

THOMPSONVILLE, CONN.—Extension of the fire-alarm system through sections of the town, recently developed for residential purposes, is under consideration by the town officials.

Middle Atlantic States

ASHEVILLE, N. Y.—The installation of a street-lighting system along the improved highways throughout the town is under consideration by the Town Board.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 22 for electrical equipment for passenger elevator at the Navy Yard, Brooklyn (Specification No. 5,158).

BUFFALO, N. Y.—The Stephen Stewart Grain Corporation, Hamburg Turnpike, plans to install electric power equipment at its proposed grain elevator, to cost about $800,000.

BUFFALO, N. Y. — The Donner Steel Company, 475 Abbott Road, has prepared plans for the complete electrification of its local steel works, to replace the present steam-driven apparatus.

BUFFALO, N. Y.—Plans for the proposed oil storage plant along the Buffalo River to be erected by McColl Brothers, Toronto, Canada, include a power plant for oil pumping service to ships.

BUFFALO, N. Y.—Bids will be received by the chairman of board of trustees of the State Institute of Malignant Diseases, Buffalo, until July 28 for construction, including heating, sanitary and electric work, of hospital building.

ITHACA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 31 for installation complete of one full magnet control electric freight elevator for the United States post office at Ithaca.

NEW YORK, N. Y. — The New York Central Railroad Company, has been ordered to prepare plans for the electrification of its lines from the Spuyten Duvell Creek to the Sixtieth Street yards, to be submitted for approval on or before Sept. 1. The company will also electrify the road from the Sixtieth Street yards to St. John's Park.

OGDENSBURG, N. Y.—Plans for the rebuilding of the plant of the Maple City Milling Company include a power plant, to cost about $30,000.

BURLINGTON, N. J.—The question of installing electric street traffic signal lamps, to cost about $2,500, is under consideration by the Council.

NEW EGYPT, N. J.—The Eastern New Jersey Power & Electric Company, Allenhurst, plans to erect a transmission line to New Egpyt for commercial service. A line will also be built to Wrightstown.

NUTLEY, N. J.—Plans have been filed by George La Monte & Son, 299 Kingsland Road, for the construction of a power house at their paper mill, to cost about $30,000.

BROOKVILLE, PA.—The Borough Council has applied to the Public Service Commission for permission to purchase the system of the Solar Electric Company, to be owned and operated by the municipality. The Penn Public Service Company has also applied for permission to purchase the property.

EASTON, PA.—Work is now under way by the Bureau of Lighting on the installation of an ornamental lighting system, consisting of 118 standards mounted with 400 cp. lamps. C. A. Reed is city engineer.

HARRISBURG, PA.—The Harrisburg Light & Power Company contemplates the installation of a turbo-generator and auxiliary equipment in its plant on Cedar Street. Extensions will be made in transmission system.

LOCK HAVEN, PA.—The City Council plans extensions to the ornamental lighting system in the business district.

PHILADELPHIA, PA. — Plans for the proposed department store to be erected by Gimbel Brothers on block bounded by Eighth, Ninth, Market and Chestnut Streets, to cost about $15,000,000, include a power plant. Graham, Anderson, Probst & White, Chicago, are architects.

WEISSPORT, PA.—The Brawer Brothers Silk Company is planning to build a power house at its plant.

BALTIMORE, MD.—The installation of an electric lighting system around Lake Montebello, to cost about $20,000, is under consideration by the City Council. V. Bernard Siems, City Hall, is water engineer.

BALTIMORE, MD. — Electric power equipment will be installed in the baking plant to be erected by the General Baking Company, 343 Madison Avenue, New York, at North Avenue and Harford Road, to cost about $450,000. C. L. Comstock, 110 West Fortieth Street, New York, is architect.

CUMBERLAND, MD.—The Potomac Edison Company plans improvements in its local power plant, including the construction of a new switching station. Extensions are contemplated to transmission lines and in the local distribution system. The cost is estimated at about $175,000.

PARKERSBURG, W. VA.—Plans for the proposed artificial silk mill to be built by the Viscose Company, Marcus Hook, Pa., to cost about $5,000,000, include a power plant.

ALEXANDRIA, VA.—Plans are being prepared by the Alexandria Light & Power Company for extensions to its power plant, including the installation of a 5,000-kw. generator, etc. Day & Zimmerman, Inc., 1600 Walnut Street, Philadelphia, is in charge.

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 31 for steel bars, bronze wire, electrical wire, projectors, extension bells, telephone, lamp fixtures, reflectors, shade holders, zincs, batteries, lead sleeving, as per circular No. 1682.

North Central States

BELDING, MICH.—The properties of the Citizens' Light Company, and the Spencer Electric Light & Power Company, both of Belding, has been acquired by the Consumers' Power Company, Jackson. Extensions and improvements in the transmission system in this district are contemplated.

COLINE, MICH.—Plans are being prepared by the Consumers' Power Company, Jackson, for a 24,000-hp. hydroelectric power development in Coline. A transmission line will be built. Coline has not a post office.

YPSILANTI, MICH.—The Detroit Edison Company, is considering rebuilding its local electric substation, recently damaged by fire, causing loss of about $70,000.

YPSILANTI, MICH.—Tentative plans are under consideration by the Fordson Power Company, Detroit, for a hydroelectric power development, to cost about $500,000, on the Huron River, near Ypsilanti, where a power site has been selected.

ARCHBOLD, OHIO.—The Archbold Electric Service Company will change its system from 110 volts, 25 cycles to 110 volts, 60 cycles in September. O. C. Lauber is secretary and manager.

CINCINNATI, OHIO.—A permit has been granted the Union Gas & Electric Company to build a substation at 2016 Dana Avenue.

CONTINENTAL, OHIO.—A special election will be held to vote on the proposal, submitted by the Ohio Power Company, Canton, for lighting the streets of the town.

HAMILTON, OHIO.—Bids will be received by the County Commissioners, until July 31, for electric wiring in the Butler County Infirmary. George W. Barkman, Riley Building, is architect. E. O. Roll is clerk.

BOWLING GREEN, KY.—The Kentucky-Tennessee Light & Power Company, plans to build a hydro-electric plant on the Green River, Lock No. 2, near Henderson, to cost about $1,000,000.

JONESVILLE, KY.—Preparations have been made by the Kentucky Utilities Company, Louisville, for the erection of a transmission from Pennington Gap to Jonesville. A distribution will be installed here, at a cost of about $24,000.

LOUISVILLE, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 3 for conduit and wiring and lighting fixtures for the United States post office at Louisville. For details see Searchlight Section.

BRAZIL, IND.—The Brazil Clay Company plans to install electric power equipment at its proposed clay products manufacturing plant to cost about $200,000.

INDIANAPOLIS, IND.—A site has been acquired by the Indianapolis Light & Heat Company on which it proposes to erect a warehouse and garage, a machine shop and administration building for line service and meter department, pole yards, etc. The plans also include a chemical pole-treating plant.

CHICAGO, ILL.—John T. Miller, commissioner of gas and electricity, has announced that a new type of street lamp will illuminate 15 miles of city streets. A new 1,000-cp. lamp will be erected in the widened thoroughfares to replace the 600-cp. lamps now in use. The cost of the installation is estimated at about $90,000.

DOWNERS GROVE, ILL.—The Western Public Service Company is building a new substation in Westmont, a 13,000-volt distribution line from Westmont to Naperville and numerous extensions to connect new territory, and also rebuilding lines in Downers Grove. Grant McCollum is manager.

MAKANDA, ILL.—The Central Illinois Public Service Company, Springfield, plans extensions in its transmission lines in this district, and in the vicinity of Nokomis, where franchises recently have been secured.

RUSHVILLE, ILL.—The Central Illinois Public Service Company, Springfield, has applied for permission to purchase the electric plant and distribution system at Rushville. The company proposes to furnish electricity from the transmission line between Macomb and Rushville to operate the local system.

BRUCE, WIS.—Permission has been granted the Lake Superior District Power Company, Ashland, by the Railroad Commission to acquire the municipal electric light and water plant, together with the village's interest in the transmission line from Bruce to Ladysmith.

MARINETTE, WIS.—The City Council has accepted the proposal of the Menominee & Marinette Light & Traction Company to replace, without cost to the city, the present arc lamps now in use. The new system will consist of fourteen lamps of 1,000 cp. on Ogden Avenue, from Parmenter Street to the upper bridge; 132 lamps of 600 cp. on both Sherman Road and Ogden Avenue, between Ludington Avenue and Parmenter Street, and 14 and 32 cp. lamps in various parts of the city.

MAUSTON, WIS.—Negotiations are under way between the City Council and the Wisconsin Power & Light Company, Madison, for improvements to the street-lighting system, including the installation of ornamental standards in some parts of the city to be equipped with lights of 250 cp. and 100 cp.

SPOONER, WIS.—The City Council has approved the proposal to extend the ornamental lighting system on Railroad Avenue.

STRATFORD, WIS.—The electric plant and system of the Stratford Light & Power Company has been acquired by the city, to be owned and operated by the municipality.

ASHTON, IOWA.—The Northwestern Light & Power Company, Mayville, Wis., is considering extensions and reconstruction of its transmission and distribution lines in this section.

CAPE GIRARDEAU, MO.—Plans are under consideration by the Community Light & Power Company, 408 Pine Street, St. Louis, to double the output of its local plant, to cost about $200,000. The work includes extension to power house and installation of a 2,500-kva. turbine, etc.

DEVILS LAKE, N. D.—Permission has been granted the Otter Tail Power Company, Fergus Falls, Minn., to erect a transmission line from Devils Lake to Michigan, with substation and distribution system in a number of communities.

DOYON, N. D.—The Lakota (N. D.) Light & Power Company is considering the erection of a transmision line from Lakota to Doyon, via Bartlett.

BEATRICE, NEB.—The City Commissioners have made provision for extension of the municipal lighting system to the amount of $40,000, which is an increase of $17,500 over last year. This appropriation will permit the extension of the municipal commercial business into the residence section.

CRAWFORD, NEB.—The Western Public Service Company plans to erect a transmission line from Chardon, to Crawford, to cost about $45,000.

MARYSVILLE, KAN.—Application has been filed with the Public Service Commission by the Kansas Light & Power Company, Topeka, for permission to issue $42,000 in capital stock, the proceeds to be used for the purposes of acquiring property in a number of towns in Marshall County, including Beatty, Holmes City, Oketo, and others, which will be supplied with electricity from the plant of the Marysville Water & Light Company, a subsidiary. The company which is now erecting a high-tension transmission line from Atchison to St. Joseph, Mo., will soon build a line from the latter place to Excelsior Springs, Mo.

Southern States

CORDELLE, GA.—Plans have been prepared by the Southern Engineering Corporation, Albany, for the construction of a 14,000-hp. hydroelectric plant on Flint River at Warwick for Crisp County. The initial installation will consist of two vertical single runner units, of 3,500 hp. each with an ultimate capacity of 14,000 hp. Bids will be asked for later.

HAWKINSVILLE, GA.—The Interstate Utilities Corporation plans the construction of a transmission line from Dublin, to this district, with substation for local commercial service.

LAFAYETTE, GA.—Contract has been awarded to the Georgia Railway & Power Company, Atlanta, to furnish electricity for the municipal system. The company plans to extend its transmission lines. The Council has plans under way for a substation.

BARTOW, FLA.—The Council is considering calling an election to vote on the proposal to issue $125,000 in bonds for extensions to the municipal electric plant.

HOLLYWOOD, FLA.—The Hollywood Land & Water Company, which is building an addition to its power house to accommodate a 1250-hp. Nordberg generator, is planning to install an additional 2400-hp. unit in 1926. A 4200-line Western Electric central energy telephone switchboard will be installed during September.

HOMESTEAD, FLA.—The City Council is considering calling a special election to vote on the proposal to issue $300,000 in bonds, the proceeds to be used for extensions and improvements in the municipal electric plant.

PALATKA, FLA.—The Southern Utilities Company is planning to erect a transmission line from St. Augustine to Miami to establish power service along the east coast of Florida.

SEBRING, FLA. — Arrangements have been made by the Lakeview Place Corporation for the installation of an ornamental lighting system through Lakeview Place and Woodlawn Terrace.

WILDWOOD, FLA.—The Seaboard Air Line Railway Company, Norfolk, Va., will install electric power equipment at its new local locomotive and car shops, to cost about $300,000.

TAMPA, FLA.—The Kreiss Potassium Phosphate Company plans to install electric power equipment in connection with proposed extensions and improvements in its plants, to cost about $500,000.

MONTEREY, TENN.—Negotiations are under way by the Tennessee Electric Power Company, Chattanooga, for the purchase of the property of the Monterey Light & Power Company. The Tennessee company plans extensions to its transmission lines in this district.

NASHVILLE, TENN. — Permission has been granted the Nashville Railway & Light Company to erect transmission lines in Sumner, Wilson, Cheatham and Williamson Counties.

LUVERNE, ALA. — The Town Council has contracted with the River Falls (Ala.) Power Company to supply electricity for utilities and industrial purposes in Luverne for a period of thirty years. The company will erect a 44,000-volt transmission line from Brantley to Luverne, a distance of 12 miles, and will purchase immediately six 200-kva. 44,000/2,300-volt, single-phase, oil-cooled transformers, line material, substation equipment, etc. The Southern Engineering Corporation, Albany, is engineer.

MONTGOMERY, ALA.—Bond Brothers, Inc., Louisville, Ky., plan to install electric power equipment at its proposed creosoting and lumber treating plant at North Montgomery, to cost about $300,000.

MULGA, ALA.—The Woodward (Ala.) Iron Company plans to build a power plant at its local coal-mining properties.

RIVER FALLS, ALA.—Surveys are being made and plans prepared by the Southern Engineering Corporation, Albany for the construction of the O'Neal plant of the River Falls Power Company on the Patsiliga River, near Gantt, to develop 7,500 hp., for which bids will be asked for later.

GULFPORT, MISS.—The erection of a 44,000-volt transmission line from a point on the Alabama-Mississippi state line near Gattman, Ala., to Starkville, via Aberdeen and West Point, is under consideration by the Mississippi Power Company.

ATKINS, ARK. — The Atkins Electric Light & Power Company plans extensions and improvements in its local plant. An ice-manufacturing plant will be installed.

NEW ORLEANS, LA.—Steps have been taken by the Magazine Market Business Men's League for the installation of an ornamental lighting system from the Magazine Market to Audubon Park on that thoroughfare.

HELENA, OKLA.—The United Power Company has submitted a proposal to the City Trustees of Medford to supply electricity there. It also offers to take over the municipal electric plant. The city of Pond Creek is also considering a proposition offered by the company for electrical service.

NORMAN, OKLA.—The City Council is considering the installation of a 200-hp. Diesel engine and generator unit at the waterworks, to cost about $30,000. F. Cobb, Norman, is engineer.

MARSHALL, TEX.—Plans are under consideration by the East Texas Public Service Company to double the output of its local plant, at a cost of about $200,000.

NEW BRAUNFELS, TEX.—Surveys are being made by the Comal Power Company for the erection of a transmission line from its plant in New Braunfels to connect with McQueenie, Schertz, Sequin, Marion and other towns, a distance of about 100 miles.

The company also plans to build a line from San Antonio to Hunter, 83 miles long, to cost about $320,000.

SAN BENITO, TEX.—The Valley Electric & Ice Company, San Antonio, plans extensions to its local plant to increase the output by 2,500 hp. The company is extending its transmission line through a new agriculture district to furnish electrical service to farmers.

Pacific and Mountain States

CENTRALIA, WASH.—The West Coast Power Company, Portland, Ore., has applied to the County Commissioners for permission to erect transmission lines on a number of county roads.

EVERETT, WASH.—The Everett Pulp & Paper Company plans to install electric power equipment in its proposed pulp mill addition, to cost about $250,000. George F. Hardy, 309 Broadway, New York, is consulting engineer.

EVERETT, WASH.—Improvements are contemplated by the Puget Sound Power & Light Company, Seattle, to its Broadway substation in Everett, to cost about $100,000. The work includes changing transformers, changing of power bank from 1,500 kw. to 6,000 kw., and construction of new switch house.

OAKVILLE, WASH. — The municipal electric plant has been acquired by the West Coast Power Company, Portland. Extensive improvements are contemplated by the new owner.

FRESNO, CAL.—The City Council is considering the installation of an ornamental lighting system on Wilson Avenue, using combination steel and cast iron standards. Andrew M. Jensen is city engineer.

LOS ANGELES, CAL.—Plans are under way by the Southern California Edison Company, for the erection of a high-tension transmission line from the power plants in the mountains back of Fresno, through Tulare, and Kern Counties to Los Angeles, to cost about $11,000,000.

LOS ANGELES, CAL.—The Department of Public Service, Bureau of Light & Power, plans to build a substation, at 6007 Eleventh Avenue, to cost about $20,000. Plans are also under way for the erection of two other substations to be located on Deering and Darby Avenues, respectively, to cost about $15,000 each.

MONROVIA, CAL.—The City Trustees have approved plans for the installation of an ornamental lighting system in the Stewart and Ainley subdivision, using concrete standards.

MONTEREY, CAL.—The City Council is considering plans for extensions to the municipal fire alarm system.

OJAI, CAL.—Plans are under consideration by the Ojai Valley Property Owners' Association for the construction of a hydroelectric plant in connection with its Sespe irrigation project. The cost of the power station and penstock is estimated at $308,000. J. B. Lippincott is consulting engineer.

PALO ALTO, CAL.—Plans are under way for the installation of an ornamental lighting system on Bryant and Emerson Street. A. V. Youens is city electrician.

SAN JOSE, CAL.—The Pacific Gas & Electric Company, San Francisco, plans to build a substation in the Branham Oaks subdivision in San Jose.

TUCSON, ARIZ.—The Coma-Pima Mining Company plans to install electric power equipment at its proposed flotation mill at its Little Mary mining properties in the Babocomi district, to cost about $200,000.

Canada

DUNCAN, B. C.—The British Columbia Electric Railway Company is considering extending its transmission lines from Bamberton to Nanaimo, via Duncan and Ladysmith.

VANCOUVER, B. C.—The City Council has authorized a new system of ornamental lamps on Nelson Street in the West End. If satisfactory, it is proposed to install the new system on a through thoroughfare to Stanley Park and on other streets in that section of the city.

MITCHELL, ONT.—The Hydro-Electric Power Commission of Ontario, Toronto, contemplates extending its transmission line from Mitchell to Monkton, and also to install an electric distributing system in Monkton, to cost about $40,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 16, 1925)

1,541,878, 1,541,879, 1,541,880, 1,541,881. SINGLE-POLAR TELEGRAPH CIRCUITS; E. F. Watson, Yonkers, N. Y. App. filed Nov. 21, 1921.

1,541,915. ELECTROMAGNETIC SEPARATOR; J. Bing, Eisenach, Germany. App. filed Nov. 10, 1924.

1,541,926. TELEPHONE SYSTEM; W. F. Davidson, St. Paul, Minn. App. filed Aug. 6, 1924. For office buildings.

1,541,937. CABLE INSTALLATION; H. W. Fisher and R. W. Atkinson, Perth Amboy, N. J. App. filed July 3, 1920. Protective apparatus for a cable containing fluid under pressure.

1,541,947. ELECTROLYTIC CELL; F. E. Hartman and H. B. Hartman, Scottdale, Pa. App. filed March 21, 1922. As used in water-purifying apparatus.

1,541,954. COMBINED BELL AND BUZZER; H. Hersh, Marinette, Wis. App. filed Oct. 19, 1920.

1,542,008. ELECTRIC RIVET HEATER; J. E. Sederholm, St. Paul, Minn. App. filed Aug. 5, 1922.

1,542,011. PORTABLE SURGICAL LIGHT; H. R. Simpson, San Francisco, Cal. App. filed Feb. 4, 1924. Dry-cell type.

1,542,038. TELAUTOGRAPH APPARATUS; A. V. Day, Paris, France. App. filed Aug. 26, 1908.

1,542,074. ELECTRIC GROUND CLAMP; W. S. Mayer, Philadelphia, Pa. App. filed Feb. 24, 1922.

1,542,105. MEASURED-SERVICE AUTOMATIC TELEPHONE SYSTEM; P. C. Smith, East Orange, N. J. App. filed June 20, 1922.

1,542,121. CARRIER-WAVE COMMUNICATING SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed April 1, 1922.

1,542,144. CORE OF TRANSFORMERS; Y. Katsumoto, Nishi-Ku, Osaka, Japan. App. filed Feb. 21, 1922.

1,542,154. PUSH-BUTTON SWITCH; S. E. Lindvall, Altona, Germany. App. filed May 24, 1924.

1,542,218. ELECTRIC IRON; L. L. Conrad, Johnstown, Pa. App. filed June 30, 1924. With control switch in handle.

1,542,229. BATTERY-CHARGING SWITCHBOARD; J. P. Gantt, Wagener, S. C. App. filed June 20, 1924.

1,542,261. ELECTRIC GENERATOR CIRCUIT; J. C. Moore, Fredonia, Pa. App. filed Oct. 10, 1923. For varying the magnetic field.

1,542,278. ELECTRIC FURNACE; R. E. Talley, Irwin, Pa. App. filed July 19, 1923. Vitreous-enameling furnace.

1,542,310. ELECTRIC SNAP SWITCH; H. E. Leppert, New Britain, Conn. App. filed Dec. 15, 1923. Toggle type.

1,542,330. ELECTRIC HEATER AND STOVE; H. P. Ball, New York, N. Y. App. filed April 3, 1922.

1,542,337. ELECTRICAL CONNECTOR FOR TOY TRAIN TRACKS; L. Caruso, Irvington, N. J. App. filed March 23, 1923.

1,542,361. INTERCONNECTION OF ELECTRICAL LINES; G. A. Betulander, Sodertorns, Villastad, Sweden. App. filed Aug. 11, 1922. In telephone plants.

1,542,366. VACUUM-TUBE BASE; W. R. Brough, East Orange, N. J. App. filed Dec. 2, 1920.

1,542,372. TRANSFORMER; W. L. Casper, Brooklyn, N. Y. App. filed Oct. 19, 1922. For use in a signaling circuit.

1,542,381. DISCHARGE-DEVICE SYSTEM; J. C. Gabriel, New York, N. Y. App. filed June 13, 1924.

1,542,383. AUTOMATIC TELEPHONE SYSTEM; A. E. Hague, Brooklyn, N. Y. App. filed April 16, 1923.

1,542,385. THERMIONIC CATHODE AND METHOD OF MAKING THE SAME; J. E. Harris, East Orange, N. J. App. filed Oct. 12, 1920.

1,542,386. VACUUM-TUBE DESIGN; R. V. L. Hartley, East Orange, N. J. App. filed Dec. 14, 1920.

1,542,389. VACUUM-INSULATED TERMINAL; W. G. Housekeeper, New York, N. Y. App. filed Nov. 19, 1920. Arrangement of the lead wires in a vacuum tube.

1,542,398. ELECTROMAGNETIC DEVICE; P. K. McGall, East Orange, N. J. App. filed Dec. 31, 1920. Electrical relay of the slow-acting type.

1,542,411. PRIME-MOVER DYNAMO PLANT; C. E. Reddig, Kew Gardens, Richmond Hill, N. Y. App. filed May 28, 1923.

1,542,413. TELEPHONE-EXCHANGE TESTING SYSTEM; J. B. Retallack, East Orange, N. J. App. filed May 9, 1924.

1,542,414. AUTOMATIC TELEPHONE SWITCH; C. D. Richard, West New Brighton, N. Y. App. filed Sept. 7, 1922.

1,542,421. CABLE BOX; H. L. Strongson, Brooklyn, N. Y. App. filed April 29, 1922. As used in building construction.

1,542,426. ALTERNATING-CURRENT POWER-TRANSMISSION PLANT; K. von Kando, Budapest, Hungary. App. filed Sept. 17, 1920. Electric railway service.

1,542,483. MOTOR-CONTROL SYSTEM; L. J. Stephenson, Oakmont, Pa. App. filed Feb. 20, 1920.

1,542,501. CIRCUIT INTERRUPTER; A. E. Greene, Medford Hillside, Mass. App. filed July 10, 1922. Oil-immersed electric switch of relatively high capacity.

1,542,524. APPARATUS FOR THE ELECTRICAL TRANSMISSION OF INTELLIGENCE; L. J. Rich, Washington, D. C. App. filed Jan. 26, 1921.

1,542,525. METHOD FOR REDUCTION OF INTERFERENCE FROM HARMONICS; L. J. Rich, Washington, D. C. App. filed Jan. 26, 1921. In producing telegraphic signals.

1,542,546. DEVICE FOR REPEATING ALTERNATING-CURRENT TELEGRAPH SIGNALS; J. P. Ferriter, Oceanport, N. J., and W. H. Johnson, Red Bank, N. J. App. filed Aug. 29, 1923.

1,542,562. FURNACE FOR MELTING AND TREATING ORES AND METALS GENERALLY; T. Levoz, Heer, Belgium. App. filed April 15, 1924.

1,542,565, 1,542,566, 1,542,567. SECRET SIGNALING; R. C. Mathes, New York, N. Y. App. filed June 30, 1923.

1,542,594. LIGHTING FIXTURE; J. A. Amos, St. Louis, Mo. App. filed June 9, 1924. Adapted for use in locomotive cabs.

1,542,604, 1,542,605, 1,542,606, 1,542,607, 1,542,608. ELECTRIC FUSE; H. T. Bussmann, St. Louis, Mo. App. filed May 7, 1919. Fuse link of variable cross-section.

1,542,649. MULTI-OFFICE TELEPHONE SYSTEM; B. D. Willis, Oak Park, Ill. App. filed May 3, 1921.

1,542,664. METHOD AND MEANS FOR SOLDERING THE SEAMS OF METALLIC BODIES; J. Brenzinger, Fairfield, Conn. App. filed March 22, 1922.

1,542,680. BATTERY TERMINAL CONNECTOR; C. M. Eberling, Cleveland, Ohio. App. filed July 17, 1922.

1,542,702. METHOD OF AND APPARATUS FOR CONTROLLING ARC WELDING; R. L. Kingsland, Fairmont, W. Va. App. filed Aug. 15, 1921.

1,542,716. MEANS FOR PROTECTING FURNACE ELECTRODES; W. H. Payne, Pittsburgh, Pa. App. filed April 18, 1923. Of the resistance type.

1,542,722. THERMOSTATIC CIRCUIT CLOSER; W. K. Pinnell, Sedalia, Col. App. filed May 25, 1922.

1,542,752 CIGAR LIGHTER; G. J. Williams and E. K. Nelson, Jr., Tampa, Fla. App. filed July 24, 1924.

1,542,753. METHOD OF WELDING ALUMINUM; S. A. Wiltsie, Erie, Pa. App. filed Nov. 11, 1922.

1,542,768. ELECTROMAGNETIC SWITCH; A. J. Heitz, Vincennes, Ind. App. filed March 26, 1924.

1,542,779. TAPE TRANSMITTER; W. C. Peterman, Rutherford, N. J. App. filed May 28, 1923.

(Issued June 23, 1925)

1,542,815. INSTRUMENT FOR LOCATING AND OBSERVING DEFECTIVE INSULATOR UNITS; C. E. Bennett, Barcelona, Spain. App. filed June 29, 1921.

1,542,822. ELECTRIC FUSE CASING; H. P. Chandler, Mansfield, Ohio. App. filed Feb. 1, 1923. For inclosed type of fuse.

1,542,846. ELECTRIC VIBRATOR FOR RAZORS AND THE LIKE; G. Adelmo, Spring Valley, Ill. App. filed March 17, 1924.

1,542,847. SIGNALING SYSTEM; R. S. Bailey, Montclair, N. J. App. filed May 10, 1922. For telephone transmission lines.

1,542,849. SIGNALING SYSTEM; H. M. Bascom, Brooklyn, N. Y. App. filed May 10, 1922. For a telephone transmission line.

1,542,850. THERMOSTAT; A. S. Curtis and D. J. Beaver, New York, N. Y. App. filed March 30, 1922. Utilizing extremely small currents to accomplish the operation of a relay.

1,542,859. REGENERATIVE VIBRATORY REPEATER FOR TELEGRAPH CIRCUITS; A. F. Connery, Springfield, N. Y. App. filed Oct. 6, 1923.

1,542,860. CABLE TELEGRAPHY; A. F. Connery, Jamaica, N. Y. App. filed April 17, 1924.

1,542,863. INSULATED ELECTRICAL CONDUCTOR; E. E. F. Creighton, Schnectady, N. Y. App. filed Jan. 10, 1918. Methods of preparing insulating material and applying it to such conductors.

Financial and Corporate

Utility Stocks Rally

Selected Issues Make Substantial Advances as Market's Tone Improves

THE market in power and light stocks nowadays is similar to the market for stocks generally in that no pronounced trend is maintained from week to week. Prices for weeks have held within a relatively narrow range, advancing and declining in turn, but with the gains usually more conspicuous than the losses. In the week under review the tone of the market appeared to be somewhat improved. At least the general trend of the issues that were actively traded in was upward. Money continues easy.

The General Gas & Electric group during the week was a leader in the advance, the common shares having touched a peak of 224 and the net gain for the week being 43 points. All of the General Gas & Electric issues improved in position smartly as announcements were made of the new plan of recapitalization by which the management hopes greatly to strengthen the capital structure of the organization. Next in importance among the gains was the advance of Southeastern Power & Light shares to a fresh high above 116, representing a rise of 10 points for the week, on such favorable news as the announcement that the Alabama Power Company would use the Muscle Shoals power temporarily, at least, and the favorable 1924 report of that leading subsidiary. The present price of 116 for Southeastern is the equivalent of 232 for the old Alabama Traction, Light & Power shares that sold as low as 30 last year.

On the New York Stock Exchange activity developed in the stock of the North American Company as the feeling grew that these shares had been neglected. They touched a new record top around 54.

New Capital Issues

With the purpose of acquiring not less than 87½ per cent of the outstanding common stock of the Kings County Lighting Company, the Long Island Lighting Company during the past week floated an issue of 6 per cent secured gold bonds, totaling $3,500,000. The Calumet Gas & Electric Company was also represented with an offering of first and refunding mortgage gold bonds, totaling $2,700,000, priced at 98½ and interest, yielding about 5.60 per cent. Proceeds will be used to retire bonds outstanding on properties recently acquired, to reimburse company for capital expenditures heretofore made, to acquire properties of the Calumet Power Company and toward the completion of construction work.

The Southwestern Light & Power Company issued 9,000 shares of cumulative preferred stock of no par value at 82½ and accrued dividend, to yield 7.27 per cent, and the Broad River Power Company issued 7 per cent cumulative preferred to the amount of $1,400,000, the price per share being $95 and accrued dividend, to yield about 7.37 per cent.

The National Electric Power Company made a new offering of 140,000 shares of class "A" participating stock at $23.75 a share to yield 7.57 per cent. It is the intention of the board of directors to declare dividends on this stock at the rate of $1.80 per share per annum for the quarter ending November 1, 1925.

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power companies:

Name of Company	Per Cent	When Payable
American Lt. & Traction, com.	1¾	Aug. 1
American Lt. & Traction, pf.	1½	Aug. 1
Edison Electric Illg., Boston	3	Aug. 1
Electric Investors, Inc., pf.	$1.75	Aug. 1
Ft. Worth Pwr. & Lt., pf.	1¾	Aug. 1
Idaho Power, pf.	1¾	Aug. 1
Knoxville Power & Light, pf.	$1.75	Aug. 1
New Orleans Public Service, com.	.56¼	July 1
Newport News & Hampton Ry., Gas & Electric, com.	1¼	Aug. 1
Northern N. Y. Utilities, pf.	1¾	Aug. 1
Northwestern Electric, 6% pf.	1½	July 1
Northwestern Electric, 1st pf.	1½	July 1
Public Service Investment, com.	$1.75	Aug. 1
Public Service Investment, pf.	$1.50	Aug. 1
Sierra Pacific Electric, pf.	1¾	Aug. 1
Texas Power & Light pf.	1¾	Aug. 1
Utica Gas & Elec., com.	$2	July 15

Company Reports

The following statements of earnings were issued during the past week by electric light and power companies for the month of May:

Name of Company	Gross Earnings for May 1925	1924
American Power & Light	$3,899,407	$3,502,024
Barcelona Trac. Lt. & Pwr.	6,802,421	6,251,088
Central Power & Light	484,627	407,457
Electric Power & Light	2,952,532	2,825,956
Manila Electric*	311,953	300,963
Southwestern Pwr. & Light	1,033,456	989,423

*June.

Interstate Public Service to Acquire New Property

The Interstate Public Service Company of Indianapolis has filed an application before the Indiana Public Service Commission asking permission to take over, without actual transfer of cash or securities, the physical property of the Indiana Power Company, another Insull utility. The power company operates electric generation and distribution systems in Morgan, Owen, Green, Pike, Davies, Knox and Sullivan Counties and an electrical generating plant at Edwardsport, on the banks of the White River. In addition, the same company has water plants in Bloomington and Worthington and a coal mine in Bicknell. The purchase is to be subject to an indebtedness of $5,995,700. The petition says the fair value of the property to be bought exceeds all its securities outstanding. The only cash or securities which may figure, if at all, the petition said, would be in connection with the acquirement of 2,301 shares of participating stock of the power company. The petition asked that the commission appraise the value of these stocks.

Annual Reports

The Ohio Edison Company in its annual report for 1924, just issued, shows net income of $350,307 after taxes, charges and depreciation, equivalent after preferred dividends to $5.56 a share earned on 50,000 shares of common stock of no par value outstanding, compared with $290,362, or $4.78 a share, in 1923. The gross earnings of $1,478,103 represent a 14.65 per cent increase over the preceding year and are accompanied by an increase in electric sales of 1,800,021 kw.-hr. The 1924 increase in the electric customers, as shown in the annual report, represents an approximate 100 per cent increase over the total number of customers served ten years ago, the 1924 gain being 6,180 customers, bringing the present number to 20,614. This also represents a 42 per cent increase over the number of customers served the previous year.

As disclosed by the report, the company successfully carried out a program of acquiring distribution systems of many small communities and connected them to the main Ohio Edison system served from a central generating station at Springfield. As a result, 27 cities and towns are now served.

To support this increase in customers and enlargement of the system the capacity of the Springfield steam-electric generating station was increased 44 per cent, bringing its present capacity to 32,700 hp. in efficient turbine units; $494,349 was expended for additions and improvements in 1924, including the installation of a 10,000-hp. turbine-generator and two additional boilers. The company adopted the customer-ownership plan in 1920 and pursued this policy in 1924 by the offering of 6.6 per cent preferred stock at $100 per share par value to the customers during the last quarter of the year.

Puget Sound Power & Light Company reports for the year ended December 31, 1924, gross earnings amounting to $12,539,869, as compared with $12,424,707 during the previous year. Net income totaled $2,529,797 after taxes, charges, depreciation, etc., equivalent after preferred dividends to $4.43 a share earned on outstanding 202,829 no par shares of common stock, compared with $2,899,105, or $7.20 a share (par $100), on 202,829 shares of common outstanding in 1923.

Net profits of the Calgary Power Company, as shown in the annual report for 1924, after all charges, were

equivalent to 5.09 per cent on the capital stock outstanding as compared with less than 2 per cent in each of the two prior years. The gross earnings were some $40,000 higher and amounted to $357,787 as compared with $317,727 in 1923. This gain has been accomplished with only an increase of $1,919 in the operating expenses. Net income advanced from $46,215 to $96,823. Additions to property account during the year 1924 amounted to $259,730.

Toledo Utility Has Had a Good Growth

Common Stock of the Toledo Edison Company Is Pledged Under New Toledo Traction, Light & Power Company's Five-Year Notes

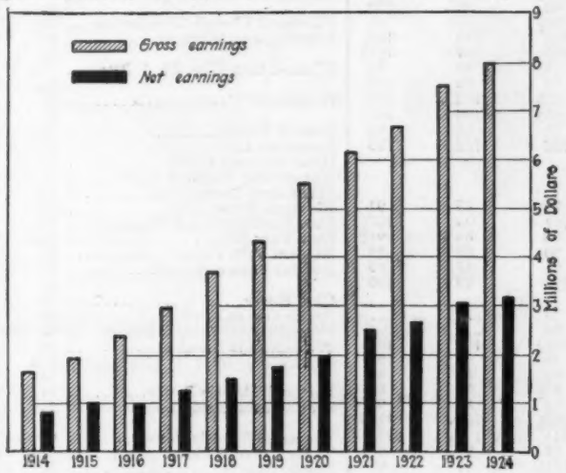
BY PAUL WILLARD GARRETT

TOLEDO Traction, Light & Power Company, which now is offering an $8,500,000 issue of five-year 5½ per cent notes at 99, or to yield 5.73 per cent, is the holding company that controls the Toledo Edison Company. It also owns a $6,945,000 issue of first mortgage bonds of the Community Traction Company, among other securities, and upon completion of the present financing will own virtually all of the securities of the Citizens Light & Power Company of Adrian, Mich. The purpose of the new note issue is, incidentally, to refund about $7,000,000 in obligations that mature August 1, 1925.

Some idea of the value of the collateral pledged behind the new notes may be gained by observing that, among other things, the Toledo Traction, Light & Power Company places its holdings of Toledo Edison common stock in the collateral so pledged. Since the holding company owns roughly 97 per cent of its principal operating company's common stock, which is to say of Toledo Edison's common stock, lenders are very well protected. The book value of the Toledo Edison Company's common stock to be pledged alone is $19,400,000. In addition the holding organization pledges such collateral as the $6,945,000 of first mortgage Community Traction Company bonds and all bonds and stock of the Citizens Light & Power Company. During the twelve months ended April 30, 1925, income accruing to the bonds and stocks to be pledged as security for the notes amounted to $1,848,778, which represents a handsome margin above the necessary annual interest requirements of only $467,500.

The Toledo Edison Company deserves special attention. This operating company does the entire electric light and power and all of the manufactured gas distributing business in Toledo, Ohio. The Community Traction, affiliated under the same parent holding company, does, incidentally, the entire electric street railway business in Toledo. That an electric property in Toledo would grow would almost be a foregone conclusion from the fact that the community itself has grown rapidly as industry has spread in that section of the country. However, theory is not needed to prove growth for the Toledo Edison Company. Gross earnings have shown a steady improvement in every year for more than a decade, the total having mounted from $1,654,305 in 1914 to $8,015,230 in 1924. Net operating revenue in the same period swelled from a yearly rate of $810,066 to $3,173,233.

Gross income was swelled to $3,284,281 by non-operating income, but interest charges in 1924 did not consume half of that total, so that, after meeting all fixed obligations, Toledo Edison showed a balance of $1,946,248. Of that $855,433 was reserved for replacement and $1,090,815 carried to surplus. Capital assets of the Toledo Edison Company at the close of last year stood at $45,832,190, virtually all of which was invested in plant and securities. On the liabilities side of the ledger stood $19,565,400 in bonds and $21,412,200 in stocks, the sum of which leaves a margin of safety when compared with the assets.



GROSS EARNINGS OF THE TOLEDO EDISON COMPANY SHOW CONSISTENT GROWTH

Vice-president Adams, in the annual report for 1924, says: "Your directors are of the opinion that during the year 1925 your company will show further increases to its business. The industrial condition generally looks much brighter than at any time during the past year, and it is the general belief that the industries of Toledo will show new high marks in 1925. A great deal of attention has been paid in the past year to increasing the load to present customers, and also the securing of new customers by extensions to new additions and into parts of the city that heretofore have never had electricity or artificial gas."

Listing.—The New York Stock Exchange has authorized the listing of additional common stock of the Pacific Gas & Electric Company totaling $2,357,000 on official notice of issuance.

Louisville Company Amends Charter.—An amendment to the charter of the Louisville Gas & Electric Company of Delaware has been filed at Dover, increasing the authorized capital from 230,000 shares to 1,300,000 shares without par value, consisting of 800,000 shares of class "A" common and 500,000 shares of class "B" common stock. Four shares of class "A" common will be issued in exchange for each share of preferred stock held, while four shares of class "B" common will be exchanged for each outstanding share of common stock.

Power Corporation Increases Common Stock.—The stockholders of the Power Corporation of New York have increased the common stock from 600,000 shares to 750,000 shares of no par value. The common stock holders of record July 20 will be given the right to subscribe for additional common stock on or before August 15 at $40 per share on the basis of one new share for each ten shares held. Proceeds will be used to pay for the company's interest in the new Mohawk & Hudson Power Corporation.

Approve Adirondack Merger.—More than 80 per cent of the shareholders of the Adirondack Power & Light Corporation have deposited their stock for merger into the new company to be known as the Mohawk & Hudson Power Corporation, details concerning the formation of which were published in the June 6 number of the ELECTRICAL WORLD.

Canadian Company Closes Campaign.—The customer-ownership campaign which was inaugurated June 15 by the Shawinigan Water & Power Company, Montreal, closed June 30 and increased the stockholders' list by 3,300. The total number of shares sold was approximately 12,000, having a value of $1,600,000. It is interesting to note that the stock was in the form of common shares, instead of preferred, as is the usual custom in customer-ownership campaigns.

Capitalization of New General Gas & Electric Announced.—The capitalization of the new General Gas & Electric Corporation of Delaware, which is to succeed the old company, as was announced in the July 4 issue of the ELECTRICAL WORLD, will consist of 400,000 shares of cumulative preferred "A" stock, without par value, the dividends not exceeding $8 a share; 100,000 shares cumulative preferred "B" stock, without par value, paying $7 annually in dividends; 800,000 shares of common class "A" stock, no par value, bearing non-cumulative dividends of $1.50 a share; 400,000 shares of common stock class "B," without par value, and 380,000 dividend participation certificates. The exchange basis was discussed at length in the issue of the ELECTRICAL WORLD referred to above.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, July 11	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	100	98	106
Appalachian Power, 7 per cent	98	92	100
Arkansas Light & Power 7 per cent	96½	92	102
Asheville Power & Light 7 per cent	a101½	101	102½
Central Illinois Public Service 6 per cent	85	84	93
Colorado Power 7 per cent	94	93	98
Connecticut Light & Power 7 per cent	106	105	110
Consumers' Power 6 per cent	94½	90	97
Dayton Power & Light 6 per cent	95	88	100
Duquesne Light 7 per cent	110½	105	111½
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	a101½	101½	103
Great Western Power 7 per cent	102	...	...
Illinois Northern Utilities 6 per cent	88	82	92
Illinois Power & Light 7 per cent	95½	92½	98
Kansas Gas & Electric 7 per cent	a101½	101½	103
Long Island Lighting 7 per cent	102	100	105
Minnesota Power & Light 7 per cent	a100	100	101
Mississippi River Power 6 per cent	92	87½	94
Nebraska Power 7 per cent	a102½	102	103½
Niagara Falls Power 7 per cent—25	28½	28	29
Niagara, Lockport & Ont. Power 7 per cent	107	101½	110
Northern States Power 7 per cent	96	95	100
Ohio Public Service 7 per cent	98	97	100
Pacific Gas & Elec. 6 per cent.	98	92	99
Pacific Power & Light 7 per cent	a101½	101	103
†Penn. Central Light & Power	69	60	69
Penn-Ohio Power & Light 7 per cent	94	91	100
Pennsylvania Power & Light $7—no par	a103½	103½	104½
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	39½	37½	45
Southern California Edison 8 per cent	125	115	128
Southern California Edison 7 per cent	107	105	107½
Southern California Edison 6 per cent	93½	90	95
Tennessee Electric Power, 6 per cent	85	80	85
Texas Power & Light 7 per cent	a102½	102	104
Utah Power & Light 7 per cent	a100½	100	101½
Western States Gas & Electric 7 per cent	89	82	92
Yadkin River Power, 7 per cent	a102	102	103
Holding Companies			
American Gas & Electric 6 per cent—no par	90	85	91
American Light & Traction 6%	101	93	101½
American Power & Light 6 per cent	93	84	91½
American Public Service 7 per cent	90	88	94
American Public Utilities 7 per cent	90	87	95
American Water Works & Electric 7 per cent	a100	99	103
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 50	...	...
Associated Gas & Electric—$6—no par	84	...	...
Carolina Power & Light $7—no par	105½	100	107
Central Indiana Power 7 per cent	90	88	95
Cities Service 6 per cent	82	80	83
Commonwealth Power 6 per cent	83½	80	85½
Continental Gas & Electric 7 per cent pr.pf.	92	89	95
Electric Bond & Share 6 per cent	a105½	105½	106½
General Gas & Electric—$8—no par	145	104½	155
*Middle West Utilities 7 per cent	97	91½	98½
National Power & Light—$7—no par	101½	95	99
North American 6 per cent—50	a 49½	46½	50½
Public Service Corp. of N. J. 7 per cent	a100½	99	102½
Public Service Corp. of N. J. 8 per cent	110	108½	114½
Standard Gas & Electric—8%—50	a 53	50½	54½
United Light & Power—$6.50—no par	90	83	99
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	86	31	93
Appalachian Power—no par	79	70	83
Arkansas Light & Power	100	65	101
Brooklyn Edison	a135	120½	140½
Buffalo General Electric—no par (new)	70	44	71½
*Commonwealth Edison	138	130½	141½
§Consolidated Gas, Electric Light & Power	43	32	45
Dayton Power & Light	420	180	460
Detroit Edison	a125½	110	125½
‖Edison Electric Illuminating of Boston	211	200	213
*Kentucky Hydro-Electric	92	85½	92½
Long Island Lighting (new)	105	60	105
Mississippi River Power	64	37	68
Montana Power	a 86	64	87
Niagara Falls Power—no par	71	45½	71
Niagara, Lockport & Ontario Power—no par	65	60	73
Northern Ohio Power	9½	5	13
Northern States Power	116	103	123½
North Texas Electric	40	40	70
Pacific Gas & Electric	a113	102½	118½
§Pennsylvania Water & Power	150	126½	152½
‡Philadelphia Electric—25	39¾	37½	47½
Public Service Co. of Northern Illinois	122	97	124
Puget Sound Power & Light	53	49	61
Southern California Edison	118	102	121
Tennessee Electric Power—no par	66	47	69
Virginia Power	66	65	92
Virginia Railway & Power	a120½	64½	123
West Penn. Co.	a119½	105	145

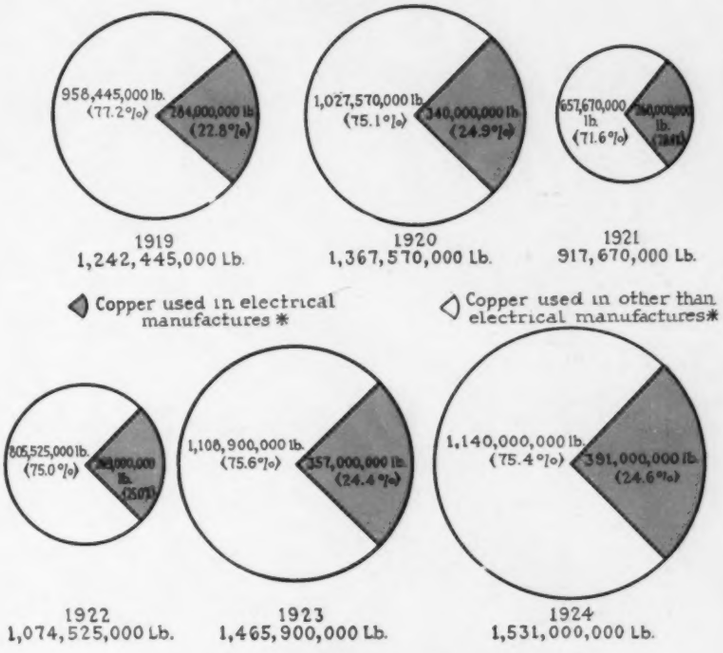
Companies	Bid Price Saturday, July 11	Low 1925	High 1925
Holding Companies			
American Gas & Electric—no par	78	70	85
American Light & Traction	170	139	173½
American Power & Light	61½	52	67
American Public Utilities	78	70	85
American Water Works & Electric	a 62½	34½	68
Associated Gas & Electric, Class A	a 39	...	...
Carolina Power & Light	390	290	425
Cities Service (new)	38½	34	43
Columbia Gas & Electric—no par	a 66½	45½	69½
Commonwealth Power Corp.—no par	162	106	168
Consolidated Gas—no par	a 87½	74½	89½
Continental Gas & Electric	115	77	99
Electric Bond & Share Securities	a 69½	68½	71½
Electric Power & Light	a 38½	17½	39½
Federal Light and Traction	a 33½	30	36
General Gas & Electric	170	72	205
Lehigh Power Securities—no par	145	82	131
*Middle West Utilities—no par	92½	82½	102½
National Power & Light—no par	340	185	357
North American—10	a 55	41½	55
Philadelphia Co.—50	a 59½	51½	61½
Power Securities—no par	14	...	...
Public Service Corp. of N. J.—no par	a 72½	62½	74
Standard Gas & Electric—no par	a 52½	40½	54½
United Gas & Electric (Conn.)—no par	48	26	49
BONDS			
Operating Companies			
Adirondack Power & Light 6s	1950	104½	102½ 105½
Alabama Power 5s	1946	99½	96 100
Appalachian Power 5s	1941	98½	96 99½
Brooklyn Edison 5s	1949	101½	99½ 103
6s	1930	103½	103½ 105½
Cleveland Electric Illuminating 5s	1939	102	100 102
Commonwealth Edison 5s	1943	102	99½ 102
5s	1953	100	98½ 101
§Consol. Gas, Elec. Lt. & Pwr. 4½s	1935	97½	93½ 97½
6s	1949	107	104½ 107½
Consumers' Power 5s	1936	100	99 100½
5s	1952	97½	90½ 100
Detroit Edison 5s	1933	101½	99½ 102½
Duquesne Light 6s	1949	106½	104½ 107½
Great Western Power 5s	1946	98½	95 99
Kansas City Power & Light 5s	1952	99½	95½ 101
Mississippi River Power 5s	1951	99½	96½ 100
Montana Power 5s	1943	100	97½ 100½
New England Power 5s	1951	102½	100½ 103
New York Edison 6½s	1941	114½	112 115½
Niagara Falls Power 6s	1932	106	103½ 106½
Northern States Power 5s	1941	98	93 99½
6s	1941	105½	103 107½
Ohio Power 7s	1951	106	106½ 107½
Pacific Gas & Electric 5s	1942	97½	93½ 99
Pennsylvania Water & Power 5s	1940	101	99½ 102
‡Philadelphia Electric 5s	1966	103	100½ 103½
5½s	1953	106	104½ 107½
6s	1941	107	106 108½
Portland Electric Power 6s	1947	100	96½ 100
Southern California Edison 5s	1939	100	99½ 101
6s	1944	104½	102½ 105½
Tennessee Electric Power 6s	1947	102½	99½ 104½
Texas Power & Light 5s	1937	98½	97 99½
Toledo Edison 7s	1941	109	108½ 110
Utah Power & Light 5s	1944	96½	91 98½
Holding Companies			
Alabama Traction, Light & Power 5s	1962	92½	86 95
American Gas & Electric 6s	2014	98	96½ 98½
American Power & Light 6s	2016	97	94 98
Amer. Water Works & Electric 5s	1934	96½	92½ 98
Associated Gas & Electric 6½s	1954	a100½	... ...
Central Indiana Power 6s	1947	98½	95½ 98½
Commonwealth Power 6s	1947	102	97½ 103½
Consolidated Cities Lt., Pwr. & Tr. 5s	1962	80½	75½ 82½
Illinois Power & Light 6s	1953	101½	100½ 102½
United Light & Railways 5s	1932	96	93½ 97½
6s	1952	99½	95½ 100½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	a106½	103½	108
*National Carbon	130	120	130
Worthington Pump & Machinery B	a 65	65	76½
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 83½	71½	86½
American Bosch Magneto—no par	a 34½	26½	54½
Electric Storage Battery—no par	a 63½	60½	70½
General Electric	a287½	227½	320
General Electric—10	a 11½	11	11½
*Hurley Machine—no par	46	41½	56
†Wagner Electric	35	26½	50
Westinghouse Electric & Manufacturing—50	a 71½	66½	84
Worthington Pump & Machinery	a 41	36½	79½
BONDS			
General Electric 3½s	1942	84½	83 85
5s	1952	107½	101½ 107½
Robbins & Myers 7s	1952	70½	63½ 73½
Western Electric 5s	1944	100	98 101
Westinghouse Electric & Mfg. 7s	1931	107	106½ 108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. ‖Boston Stock Exchange. §Baltimore Stock Exchange.
a Bid price, low and high, Tuesday, July 14.

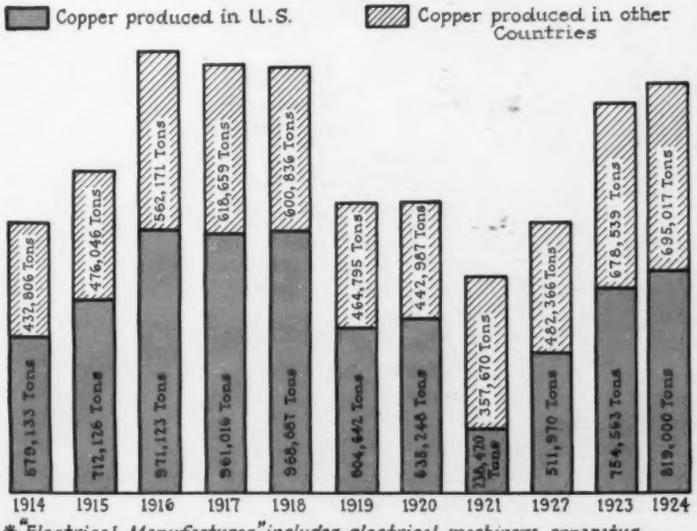
Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Copper Used in Electrical Manufacture in the United States



How the United States Ranks in Copper Production



*"Electrical Manufactures" includes electrical machinery, apparatus, accessories, etc., but not conductors

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

The Mainspring

THE watch and the clock depend upon the tiny mainspring to perform their duties of keeping accurate time. Take away this small coil of wire and the functions of these timekeepers are as nil, merely a group of wheels and gears without life or action. And so it is with industrial life. Every industry has some one essential part or necessary raw product which if taken away will throw that industry into chaos.

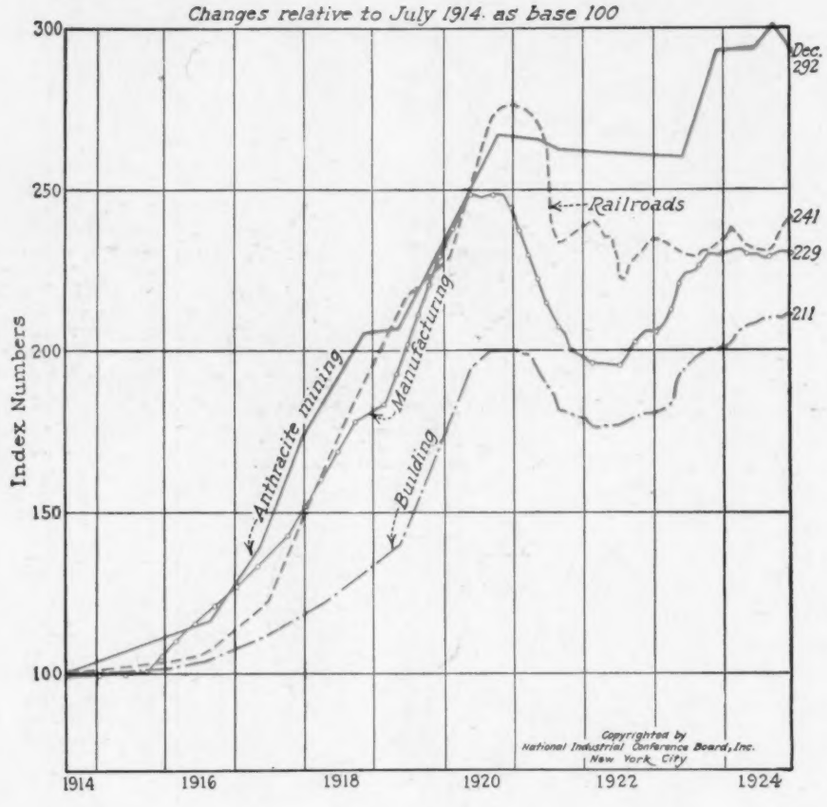
Within the electrical industry we find that life-giving substance in copper. Without copper there would be no electrical industry as we know it today. Substitutes have been found which can fulfill certain functions to a high degree of efficiency. But these substitutes for copper are limited in their electrical properties, conductivity, strength, endurance, etc., so that while they may and do fill certain fields of service, yet they are not adaptable to other important functions. Copper is the heart, the mainspring of electrical activity. It is interesting, therefore, to consider where this all important metal hails from, and what proportion of the total production is used in the manufacture of electrical apparatus, appliances and supplies.

Considerably more than half of the world's copper production is mined in the United States, and in only one year, 1921, within the past decade, has the major production been attributed to foreign countries. The United States produces almost twice as much copper as is used by the manufacturers of electrical apparatus and supplies, but not including conductors. So that this country may be said to be self-supporting in so far as copper used by the electrical industry is concerned.

Of the copper used in manufacturing during 1924, 391,000,000 lb., or 24.6 per cent, was used in the manufacture of electrical machinery, apparatus, accessories, etc., but not including conductors. The amount of copper used in electrical manufactures has been increasing yearly, except during the years of industrial inactivity, 1921 and 1922, when the consumption of copper by the electrical industry was materially curtailed. The consumption by the electrical industry during 1924 was 34.000,000 lb. greater than during 1923, which gives a fair picture of the increased activity within the electrical manufacturing industry during 1924.

These figures are taken from the 1924 Yearbook of the American Bureau of Metal Statistics.

Hourly Wages in the Mining Industry Have Increased 192 per Cent Since 1924



The Wage Question

WITHOUT question the most important problem before industry today is that of wages. It is reflected in the price of all commodities and is paramount in every discussion relating to production. Since 1914 wages in all types of industry have pyramided year by year, far out-distancing the legitimate rise necessary to offset the general increase in the cost of living and in the decreasing purchasing power of the dollar. The unsoundness of this economic condition is brought to the front at just this time by the demands of the anthracite miners for material increases of wages when their contract expires with the operators on August 31 of this year. Since in 1924 the central station industry consumed 37,556,000 tons of coal, this demand of the miners, which if put across will mean higher coal prices, becomes a subject of vital interest to the electric light and power industry. Just what is the wage status of the anthracite miners?

Wages of anthracite miners have risen considerably more during the past ten years than those of workers in the manufacturing industries, in railroads or in the electric light and power industry, according to a survey just completed by the National Industrial Conference Board. Average hourly earnings of workers in the anthracite mines from June, 1914, until December, 1924, rose 192 per cent, while hourly wages in twenty-five basic manufacturing industries during the same period increased only 129 per cent, hourly earnings of workers in Class I railroads 141 per cent, those of workers in illuminating gas plants 111 per cent, and in electric light and power establishments 121 per cent.

Increase in "real" earnings of anthracite workers, that is, wages in terms of purchasing power owing to the general increase in cost of living, is somewhat less, of course, than the increase in actual wages. Average "real" hourly earnings of all anthracite mine workers show an increase of 76 per cent over those of pre-war days, as against an increase of 45 per cent of earnings of railroad workers, 38 per cent in manufacturing industries and 36 per cent in "real" earnings of wage earners in electric light and power establishments. While other industrial wages decreased somewhat since the peak year 1920, wages in the anthracite mines have shown practically no recessions.

And in the interim between now and September 1 it would be well for the central station executive to look with a contemplative eye to his surplus coal pile, recalling the unpreparedness of a couple of years ago.